

BRAIN WORK RECURSIVE THERAPY FOR NON-COMPLEX TRAUMA:
A CASE SERIES DESIGN

Hayley Louise Rose, BSc (Hons), MSc, PGCert

Doctorate in Clinical Psychology
University of Lincoln
Faculty of Health and Social Sciences
School of Psychology

A thesis submitted in partial fulfilment of the requirements of the University of
Lincoln for the degree of Doctor of Clinical Psychology.

2018

Portfolio Abstract

Background

Trauma exposure is common throughout the world, yet only a small minority of people in the population develop post-traumatic stress disorder (PTSD). Increasingly research has demonstrated that adverse life events (e.g., relationship breakdowns) that do not meet PTSD diagnostic criterion, can produce effects comparable to major trauma causing significant psychosocial impairment. Existing trauma therapies recommended by National Institute of Clinical Excellence (NICE,2005) are limited to Trauma-focused Cognitive Behavioural Therapy (TF-CBT) and Eye Movement Desensitisation Reprocessing (EMDR). Whilst both therapies have achieved evidence-based status having accumulated a large body of research supporting their use, their tolerability and longevity of effects remain questionable. Brain Work Recursive Therapy (BWRT) is a new addition to the psychotherapy arena. Not yet subject to controlled research, the positive claims regarding the effectiveness of BWRT are limited to anecdotal evidence. Yet, BWRT appears to share procedural elements compatible with EMDR, namely dual taxation of working memory (WM) which is a key mechanism considered to influence outcome in EMDR. However, questions remain regarding if, and how, BWRT works, therefore, this current study is considered an important piece of work towards the efficacy and evidence development of this nascent therapy.

Method

This exploratory study utilised a multiple single-case experimental design (n=6) and implemented a psychosomatic, mixed-method approach. An A-B-C design was adopted which included baseline, intervention, consolidation and two follow-up phases, at one month and two months post-intervention for each participant to evaluate the stability of any effects.

Results

Four participants showed reliable and clinically significant reduction in traumatic stress symptomology from pre-intervention to 1-week post-intervention, which were maintained or further improved at subsequent follow-ups. Overall, concurrent improvements were also found on measures of psychological distress and Quality of Life. In-session ratings of memory vividness and arousal decreased markedly

following the introduction of recursive loop(s), offering potential support for the WM account of dual taxation. All participants experienced a rise in parasympathetic activity and a decrease in heartrate (HR) at the end of treatment, indicative of arousal reduction which was coherent with reductions on self-reported arousal ratings. Furthermore, four participants showed an increase in heartrate variability (HRV) variables from pre- to post-treatment. Qualitative findings revealed five participants had found BWRT helpful and considered the intervention responsible for change. In particular, limited exposure to the trauma memory and the immediacy of improvement experienced by participants was cited as positive aspects of the therapy.

Conclusion

To conclude, this was an exploratory study offering the first controlled research of BWRT. The results demonstrated an overall improvement with both psychological tests and HRV measures. Despite the limitations identified with regards to measurement, these initial case series findings offer support for the effectiveness of BWRT for non-complex trauma; a finding that was substantiated by participants' qualitative reports. Future research recommendations include the use of additional physiological measurement, working memory assessments to determine the effects of working memory capacity on outcome and the use of dismantling studies to decompose the multi-components of this nascent therapy.

Acknowledgements

I would like to take this opportunity to give my sincere thanks to my research supervisors, Dr David Dawson and Dr Thomas Schröder. Dr Dawson has been an unwavering source of support and encouragement throughout the research process and I can say with confidence that without his continual guidance I would not have been able to complete this research. I also owe Dr Dawson thanks for actually introducing me to Brain Work Recursive Therapy (BWRT) and making this research possible, and a further thank you for Dr Schröder for sticking with me when my first project was abandoned and joining me on the BWRT journey.

I would also like to thank all the participants who took part in the study. This research would not have been possible without their commitment and willingness to address their traumatic stress. Similarly, special thanks goes to Anne, Bridget, Lynsey and the rest of the Physical Health Psychology team who offered their time and resources to make this research possible, you have all been an absolute pleasure to work with.

I owe a considerable thank you to my friends and family for their encouragement and patience during this process, they were great motivators and kept me going when my tank was running empty.

I would like to give a big thank you to my boyfriend, Aris Sigalas. Thank you for your support, humour, love, and understanding. I hope I can be as helpful to you during your academic endeavours!

Finally, I would like to dedicate my thesis to my dad. Sadly my dad passed away before I was accepted onto the doctorate, and although I know he would definitely not read the entirety of my thesis (far too long), I hope my achievements here would make him proud.

Statement of contribution

Journal article and extended paper:

- Project design: Hayley Rose, Dr David Dawson and Dr Thomas Schröder
- Applying for ethical approval: Hayley Rose
- Recruiting participants: Lynsey Wood, Bridget Goard and Shelly McGill
- Data collection: Hayley Rose (Creation of internet-accessible measures supported by Dr David Dawson). Bridget Goard, Anne Abey and Lynsey Wood (treating therapists, collected measures pre-intervention and physiological measurement during the intervention)
- Scoring measures: Hayley Rose
- Conducting change interviews: Hayley Rose
- Treatment fidelity checks: Hayley Rose and Dr David Dawson
- Data entry: Hayley Rose
- Data analysis: Hayley Rose (Supervised by Dr David Dawson and Dr Thomas Schröder)
- Write-up: Hayley Rose (Supervised by Dr David Dawson and Dr Thomas Schröder)

Table of Contents

Portfolio Abstract	1
Acknowledgements	3
Statement of Contribution	4
Systematic Review	11
Abstract	13
Introduction	14
Method	17
<i>Eligibility Criteria</i>	17
<i>Study Selection</i>	18
<i>Data Abstraction</i>	20
<i>Critical Appraisal of Study Quality</i>	20
Results and Data Synthesis	21
<i>Sample Size</i>	22
<i>Protocols, Targets and Fidelity</i>	22
<i>Addiction Focus</i>	23
<i>Sessions</i>	24
<i>Measurement Strategy</i>	25
<i>Control Group and Effect Sizes</i>	25
<i>Abstinent Requirement</i>	27
<i>General Characteristics and Key Findings</i>	28
<i>Quality Appraisal</i>	72
Discussion	78
References	83
Journal Paper	95
Abstract	98
Introduction	99
<i>Aims</i>	108
<i>Hypotheses</i>	109

Method.....	109
<i>Ethics.....</i>	<i>109</i>
<i>Design.....</i>	<i>109</i>
<i>Participants.....</i>	<i>110</i>
<i>Demographics.....</i>	<i>111</i>
<i>Measures.....</i>	<i>114</i>
<i>Procedure.....</i>	<i>121</i>
Analysis.....	124
Results.....	126
<i>Quantitative Results.....</i>	<i>126</i>
<i>Qualitative Results.....</i>	<i>138</i>
Discussion.....	150
References.....	156
Extended Paper.....	179
1. Extended Introduction.....	181
<i>1.1 Trauma and PTSD.....</i>	<i>181</i>
<i>1.2 Epidemiology of Trauma.....</i>	<i>182</i>
<i>1.2.1 Gender Differences.....</i>	<i>184</i>
<i>1.2.2 Comorbidity.....</i>	<i>185</i>
<i>1.3 Risk Factors.....</i>	<i>185</i>
<i>1.4 Trauma Models.....</i>	<i>187</i>
<i>1.4.1 Conditioning Model.....</i>	<i>187</i>
<i>1.4.2 Cognitive Model.....</i>	<i>188</i>
<i>1.4.3 Emotional Processing Model.....</i>	<i>189</i>
<i>1.4.4 Polyvagal Theory.....</i>	<i>190</i>
<i>1.4.4.1 Heart rate Variability.....</i>	<i>192</i>
<i>1.4.5 Adaptive Information Processing.....</i>	<i>193</i>
<i>1.4.6 Brain Work Recursive Therapy.....</i>	<i>194</i>
<i>1.4.6.1 Research of Benjamin Libet and Successors.....</i>	<i>194</i>

1.4.6.2 Application of BWRT.....	195
1.5 Treatment Mechanisms.....	196
1.5.1 Exposure and Habituation.....	196
1.5.1.1 Brain Work Recursive Therapy.....	198
1.5.2 Dual Taxation of Working Memory.....	200
1.5.2.1 Physiological Effects.....	202
1.5.2.2 Brain Work Recursive Therapy.....	203
1.6 Clinical Relevance.....	204
2. Extended Method.....	205
2.1 Epistemological Position.....	205
2.2 Single Case Experimental Design.....	207
2.3 Participant Inclusion and Exclusion Criteria.....	209
2.4 Overview of Measures.....	209
2.4.1 Impact of Event Scale.....	210
2.4.1.1 Alternative Measure.....	210
2.4.2 Hospital Anxiety and Depression Scale.....	211
2.4.2.1 Alternative Measure.....	211
2.4.2.2 Abbreviated Hospital Anxiety and Depression Scale	211
2.4.3 Short Form Health Survey -12.....	212
2.4.3.1 Alternative Measure.....	212
2.4.4 Perceived Arousal and Vividness Likert scales.....	213
2.4.5 Heartrate Variability.....	213
2.4.5.1 Alternative Measure.....	214
2.5 Fidelity Checklist.....	214
2.6 Interpersonal Process Recall and Change Interview.....	215
2.7 Ethical Considerations.....	215
2.7.1 Informed Consent.....	216
2.7.2 Right to Withdraw.....	216
2.7.3 Confidentiality.....	216

2.7.4 Protection of Participants.....	217
2.7.5 Compensation.....	217
2.8 Analysis.....	217
2.8.1 Critique of Analysis Methods.....	223
2.8.1.1 Visual Analysis.....	223
2.8.1.2 Fisher Dual Criteria.....	223
2.8.1.3 RCI and CSC Method.....	225
3. Extended Results.....	226
3.1 Heartrate Variability.....	226
3.2 Summary of Results for each Participant.....	230
3.2.1 Participant One.....	230
3.2.2 Participant Two.....	231
3.2.3 Participant Three.....	232
3.2.4 Participant Four.....	234
3.2.5 Participant Five.....	235
3.2.6 Participant Six.....	236
4. Discussion.....	238
4.1 Treatment effectiveness.....	238
4.2 Findings in the Context of Previous Research and Theory.....	239
4.2.1 Exposure and Habituation.....	239
4.2.2 Dual Taxation of Working Memory.....	241
4.2.2.1 BWRT and EMDR.....	243
4.2.3 Polyvagal Theory.....	245
4.3 Experience of BWRT.....	246
4.4 Research Strengths.....	246
4.5 Research Limitations.....	247
4.6 Clinical Implications and Future Research.....	248
5. Personal Reflections.....	250
Extended References.....	255

Appendix A:	
Protocol Descriptions.....	303
Appendix B:	
Database Search Strategies.....	306
Appendix C:	
Platinum Standard Item Description.....	308
Appendix D:	
Ethics Approval.....	311
Appendix E:	
Participant Information Sheet.....	312
Appendix F:	
Impact of Events Scale-6 measure.....	316
Appendix G:	
GP Letter.....	317
Appendix H:	
Participant Consent Form.....	318
Appendix I:	
Hospital Anxiety and Depression Scale-4.....	320
Appendix J:	
In-session Memory Ratings Scale.....	321
Appendix K:	
Interview Schedule.....	322
Appendix L:	
Participant Debrief Letter.....	324
Thesis Poster	326

List of Tables

1. Platinum Standard (PS) assessment criteria.....	20
2. General characteristics and key findings.....	28
3. Quality appraisal.....	72
4. BWRT treatment protocol.....	105
5. Participant demographics.....	112
6. Measures completed.....	116
7. Outcome measure scores with reliable and clinical change markers.....	135
8. Within-session HRV and HR data.....	137
9. Pre-and post-intervention data for HRV variables.....	137
10. Cued recall data for all participants summarised by question.....	140
11. Change interview data for all participants summarised by question.....	145
12. Polyvagal theory: The three phylogenetic stages and constituent responses....	191
13. RCI values generated from self-report measures.....	220
14. Referent data of group comparison norms for RCI and CSC calculations.....	222
15. HRV variables extrapolated pre- and post-intervention in line with Task Force (1996) recommendations.....	229

List of Figures

1. Flow chart of study selection procedure.....	19
2. Flow chart of study procedure.....	123
3. Participant one graphed time-series data and in-session process measures.....	127
4. Participant two graphed time-series data and in-session process measures.....	128
5. Participant three graphed time-series data and in-session process measures.....	129
6. Participant four graphed time-series data and in-session process measures.....	130
7. Participant five graphed time-series data and in-session process measures.....	131
8. Participant six graphed time-series data and in-session process measures.....	132
9. RCI calculation.....	218
10. Standard Error of Difference calculation.....	219
11. Standard Error of Measurement calculation.....	219
12. HRV data collected across study phases.....	227

Systematic Review

Hayley Rose¹, Dr Thomas Schröder², Dr Rachel Sabin-Farrell²

¹ Trent Doctorate in Clinical Psychology, College of Social Sciences, University of Lincoln,
1st Floor, Bridge House, Brayford Pool, Lincoln, LN6 7TS, UK. Email:
15591140@students.lincoln.ac.uk

² Trent Doctorate in Clinical Psychology, Division of Psychiatry & Applied
Psychology, University of Nottingham, YANG Fujia Building, B Floor Jubilee
Campus, Wollaton Road, Nottingham, NG8 1BB, UK.

Is EMDR an Effective Treatment for Reducing the Frequency of Addiction? A Systematic Review

Addiction is often found to coexist with high levels of traumatic exposure. Consequently, eye movement desensitisation reprocessing (EMDR) has been recommended as a treatment for addiction, however, no systematic review has been conducted examining the incremental efficacy of EMDR for addiction. A systematic approach identified fourteen relevant studies via electronic databases and hand-searching reference lists. Relevant data were extracted and synthesised; methodological quality was assessed with the Platinum Standard appraisal tool. Studies predominantly demonstrated positive outcomes, namely abstinence or controlled use which were durable over time. However, considerable heterogeneity amongst studies specifically the methodology, and the appraised study quality lead to insufficient evidence for definite treatment recommendations; nonetheless, these promising results suggest further high-quality research examining the use of EMDR in addiction treatment is warranted.

Keywords: eye movement desensitisation and reprocessing (EMDR); addiction; trauma; effectiveness; systematic review

Addiction¹ can be defined in many ways. Traditionally, addiction has been conceptualised as a dependence on exogenous drugs of abuse triggering neuroadaptation, impaired control, and behavioural salience (Karim & Chaudhri, 2012). However, an increasing view proposes addiction can occur even in the absence of drug taking and, therefore, must be redefined to include the repetitive and harmful nature of many other behaviours in the human repertoire (Karim & Chaudhri, 2012; Martin & Petry, 2005; Potenza, 2006). Some have argued that the inclusion of behavioural addictions such as pathological gambling and sex addiction, serves to medicalise excessive ‘bad behaviour’; however, there is considerable support to suggest chemical and behavioural addiction share neurobiological underpinnings (Karim & Chaudhri, 2012; Potenza, 2006; McLellan, Lewis, Brien, & Kleber, 2000). In response to a drug or behaviour, structural and functional changes in the brain associated with reward, emotion, and decision-making occur through learning and memory (Hyman 2005), this leads to altered reinforcement contingencies creating habit formation during addiction (Martin & Petry, 2005). Moreover, repeated pairings of a person, place, thing (i.e. wages), or even an emotional state with addictive actions can result in rapid conditioning, whereby cue-induced behaviours become so strong that they reinforce particular drug-related and non-drug-addictive behaviours despite their negative consequences (Karim & Chaudhri, 2012; Volkow & Fowler, 2000). Subsequently, repeated doses and patterns of chemical and behavioural addictions respectively, lead to an individual’s decreasing volitional ability to forgo the addictive act.

Addictions can cause enormous suffering in people’s lives and are often accompanied with financial, emotional, and physical difficulties (Miller, 2010). The expensive effects of chemical addiction in particular for the wider society have been important for shaping a public opinion that views drug abuse as a social problem, requiring interdiction and policing rather than prevention and treatment (McLellan et al., 2000). However, psychotraumatic antecedents are frequently found to coexist with addiction (Peirce, Kindbom, Waesche, Yuscavage, & Brooner, 2008), this trauma can warrant a formal posttraumatic stress disorder (PTSD) diagnosis or it can be a ‘small-t trauma’, which are negative life events that, when unresolved, cause disturbance (Shapiro, 2001). It is important to state that not every addicted individual is enduring the effects of unresolved trauma, and not every trauma survivor uses addiction to cope (Brown, 2003). That being said co-morbidity between PTSD and substance

¹ For the purpose of this review the term ‘addiction’ encompasses both chemical and behavioural addictions unless otherwise specified.

use disorder (SUD) is well established (Floen & Elklit, 2007) with prevalence estimates ranging from 11% to 41% for PTSD in samples of people with SUD (Harrington & Newman, 2007; van Dam, Ehring, Vedel, & Emmelkamp, 2010). Moreover, there is increasing interest in the role of trauma amongst behavioural addiction, Cox and Howard (2007) conceptualised their patient's sexual addiction as a highly addictive attachment created by a traumatising event. Ledgerwood and Petry (2006) found one third of their pathological gambling sample met the criteria for PTSD. The number of people affected by behavioural addictions is not well documented because these disorders are frequently undiagnosed (Tamam, Zengin, Karakus, & Ozturk, 2008).

The self-medication hypothesis suggests mood-altering chemicals are used by individuals to ameliorate PTSD symptomatology (Cash, 2006), arguably this could encompass behavioural compulsions which are also considered an adaptation to avoid discomfort (Karim & Chaudhri, 2012). Furthermore, the high-risk hypothesis proposes individuals who use alcohol and chemical substances live riskier lives and, therefore, have a higher likelihood of trauma exposure (Cash, 2006). Although many psychological treatments for addiction exist (i.e. cognitive behavioural therapy (CBT), motivational interviewing, 12-step groups), most have not undergone rigorous empirical validation (Rizeanu, 2012). CBT has received the most attention and is suggested as a promising modality for internet addiction disorder (Young, 2007), pathological gambling (Gooding & Tarrier, 2009), sexual addiction (Schneider, 2004), and SUD for which it is better established (Emmelkamp & Vedel, 2006; Najavits & Hein, 2013). However, traditional models of addiction recovery and relapse prevention have been criticised for failing to consider the role of unresolved trauma in maintaining the addiction cycle (Miller & Guidry, 2001; Zweben & Yeary, 2006). Unaddressed trauma can make it difficult for patients to achieve abstinence or become a relapse factor in their effort to maintain it (Marich, 2010).

EMDR therapy is a psychotherapeutic approach that was developed to resolve disorders related to trauma (Shapiro, 2001) and has achieved international status as an evidence based treatment for PTSD (Foa, Keane, Friedman, & Cohen, 2009). The theory used to explain the workings of EMDR is the Adaptive Information Processing (AIP) model. The model assumes that, except for symptoms caused by organic deficit, the originator of psychopathology is inadequately processed memories of earlier traumata that have been stored in isolation with all the attendant state-specific characteristics, and which are repeatedly activated by environmental cues (Shapiro, 2014). EMDR enables the brain to

access the stored experience and accelerate the information processing system through the use of visual, auditory, or tactile bilateral stimulation (Logie, 2014). The processing of these memories ultimately transmutes them into a neurologically more adaptive state, leading to a lessening or elimination of the associated distress (Oren & Solomon, 2012). The use of EMDR in the treatment of addictions was considered early in its development (Shapiro, Vogelmann-Sine, & Sine, 1994) due to the frequent comorbidity of PTSD and SUD.

Addictions are disorders of learning and memory (Rougemont-Bucking & Zimmermann, 2012) and, therefore, it is suggested EMDR can be used to desensitise memories that contribute to addiction, triggers of use, and the relapse process, ultimately freeing the patient to have a wider array of behavioral choices (Brown, 2003; O'Brien & Abel, 2011). In recent years, creative alterations to the standard EMDR protocol have been put forward, the most commonly used being the Desensitisation of Triggers and Urge Reprocessing protocol (DeTUR; Popky, 2005), the CravEx (Hase, 2010), and the Feeling-State Addiction Protocol (FSAP; Miller, 2012). They all utilise desensitisation to reduce a patient's reactivity to specific cues which lead to the addictive behaviours. However, the targets utilised to accomplish reduced reactivity diverge greatly (*see appendix for full description of protocols*), in addition to the requirements (or lack thereof) for patient abstinence before embarking on treatment (Abel & O'Brien, 2010). Moreover, the harm reduction approach which involves supporting patients to reduce their engagement in the addictive act, or reduce the negative consequences, has gained more acceptance (Marlatt & Witkiewitz, 2002). Therefore, patient abstinence may not be necessary nor desired at the beginning or end of therapy.

Despite a growing body of literature regarding the use of EMDR in the treatment of addiction in recent years, and claims of EMDR effectiveness with the addiction population, there has been no systematic review conducted to date. Therefore, this review aims to systematically summarise the current evidence pertaining to the use of EMDR in addiction treatment and to discuss the implications and conclusions that can be drawn from it.

The primary question to be addressed by the review was: Is EMDR an effective treatment for reducing the frequency of addiction? Secondly to this, the review aimed to answer the following:

- Can patients benefit from EMDR if they are still engaged in their respective addiction?
- Is it necessary for therapists to employ addiction-orientated protocols to achieve positive outcomes?
- What is the quality of available evidence in this area?
- What recommendations are salient for future research?

Method

To review the literature on EMDR and addiction, five electronic bibliographic databases (Medline, EMBASE, PsycINFO, PILOTS, Francine Shapiro Library) were searched systematically during June 2016. No time limits were imposed. The search focused on two key concepts of the literature review question²: (1) EMDR and (2) addiction. For each search concept, a variety of terms and synonyms was used to ensure breadth of results which included both behavioural and chemical addictions; variations on terms were captured using truncation symbols (e.g., ‘Alcohol*’ to include ‘Alcoholics’ and ‘Alcoholism’). The search term “desensiti?ation” was used to ensure both the British spelling (desensitisation) and American spelling (desensitization) were included in the results. The search strategy was adapted for each database, in relation to the specific subject headings (thesauri) and limits (categories) employed (*see appendix for complete search strategy*). Additionally, reference lists of selected articles that met our eligibility criteria were hand-searched, so as to detect any relevant publications that may not have been identified by the database searches.

Eligibility Criteria

Studies were included if they reported quantitative outcome data pertaining to the use of EMDR in the treatment of addiction; reported primary data; inclusion of chemical and/or behavioural addiction(s); not restricted to age; were published in English; and were published in peer-reviewed journals (minimum quality threshold). Two papers Barbieri (2008) and Brown, Gilman, Goodman, Alder-Tapia, and Freng (2015) were excluded for having a limited focus on EMDR, and a limited focus on addiction respectively.

² ‘Effective’ was not searched as a concept to enable a broadly sensitive search which would identify the best evidence currently available on EMDR and addiction, however, the eligibility criteria was then applied to enable sufficient specificity.

Study Selection

The combined electronic bibliographic database searches elicited 439 results (see Fig. 1). A title screen of 299 references saw 48 articles remain, the abstracts of these papers were reviewed to determine inclusion. A total of 22 papers met the eligibility criteria for full-text paper review, which resulted in a further exclusion of 8 studies, leaving a total of 14 papers for inclusion. The reference lists of all 14 papers were hand searched, in addition to all qualitative/discussion papers which were relevant to the topic (N=8) but excluded from the review on the basis of inclusion criteria requiring quantitative outcome data for extraction. Reference list searching identified 3 further studies for review, however, these were later excluded for not meeting eligibility criteria, therefore, a total of 14 papers were included for systematic review.

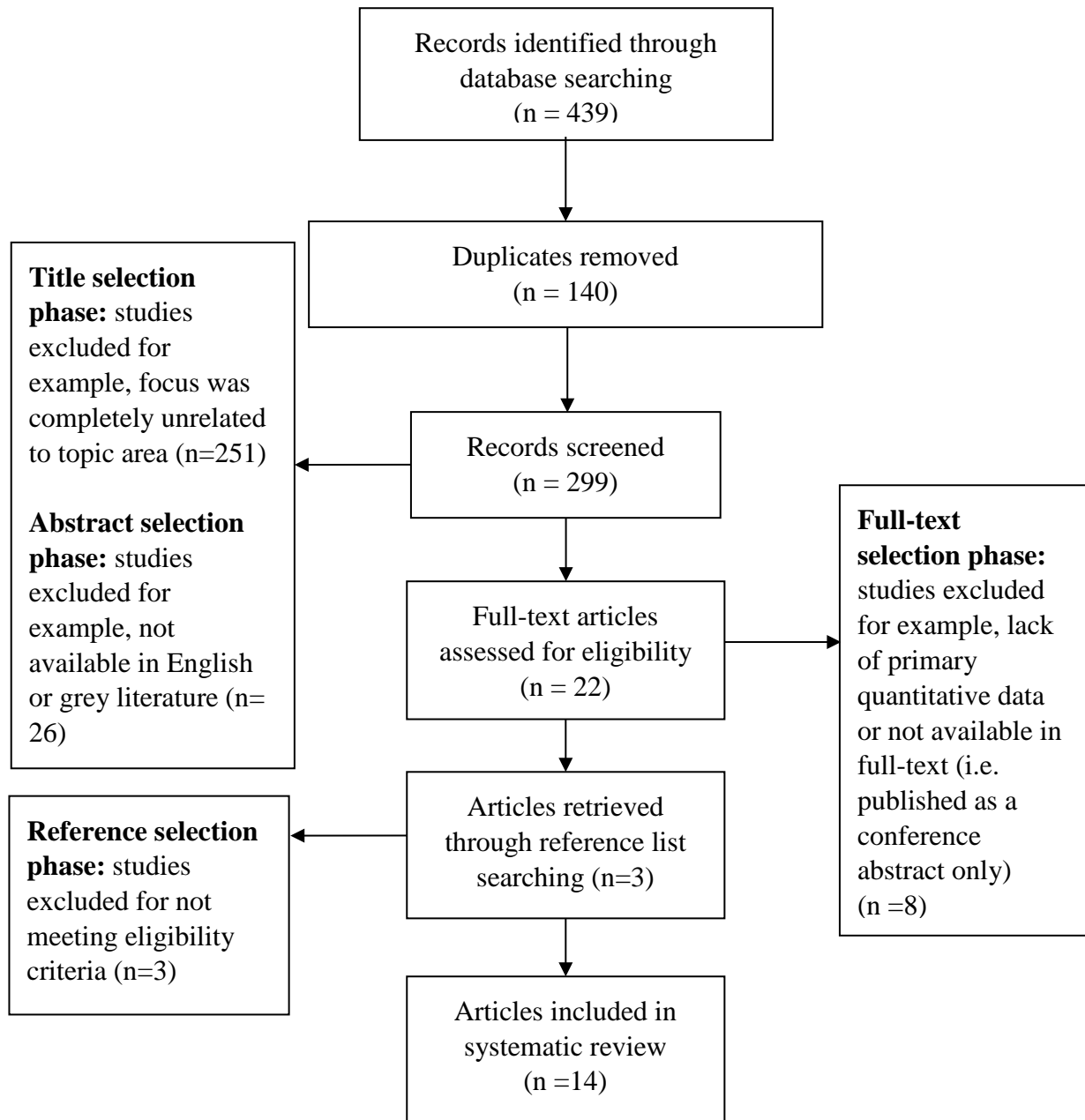


Figure 1. Flow chart illustrating study selection procedure.

Data Abstraction

The first author independently extracted data using a pre-specified data extraction form. Data regarding the descriptive characteristics of the participants and characteristics of the treatments were collected. All outcomes of relevance to the review were recorded and, if possible, follow-up means of the controlled studies adopting a pre- and posttreatment design were converted and described as effect sizes for cross comparisons. The decision to attend to these characteristics was taken with reference to pertinent variables in the literature concerning intervention studies. The general characteristics and key findings of the reviewed studies are tabulated in table 2.

Critical Appraisal of Study Quality

The methodological rigour of the studies under review was assessed using the Platinum Standard (PS) assessment tool. The PS is a comprehensive quality rating tool developed to guide the evaluation of effectiveness in EMDR research (Hertlein & Ricci, 2004). The PS is a modification of a previous EMDR quality rating tool termed the 'Revised Gold Standard' (Maxfield & Hyer, 2002), which itself was a derivative of the original EMDR rating tool referred to as the 'Gold Standard' (Foa & Meadows, 1997). The tool has continually evolved through the additions of further quality criteria. Although the PS is similar to other rating tools regarding the appraisal of study design, such as the Critical Appraisal Skills Programme (CASP, 2011), it also takes treatment-specific aspects of EMDR into consideration which are applicable to most study designs. The PS was successfully implemented in a recent systematic review investigating the use of EMDR treatment in chronic pain patients (Tesarz et al., 2014). Table 1 outlines the assessment tool criteria (*see appendix for detailed assessment criteria*).

Table 1

Platinum Standard (PS) assessment criteria

Criteria	Rating
Item #1 clearly defined target symptoms	'1.0' criteria fully met
Item #2 reliable and valid measures	'0.5' criteria partially met
Item #3 use of blind, independent assessor	'0' criteria not met

Criteria	Rating
Item #4 assessor reliability	N/A category given when the study is unable to meet the criteria due to the research design
Item #5 manualised, replicable, specific treatment	
Item #6 unbiased assignment to treatment	
Item #7 treatment adherence	
Item #8 non-confounded conditions	
Item #9 use of multimodal measures	
Item #10 length of treatment	
Item #11 reported level of therapist(s) training	
Item #12 use of control or comparison group	
Item #13 effect size reporting	

Studies not reporting on a criterion were given a rating of zero, as it must be assumed that this criterion was not considered in the research design. An overall score was reached by summing these points together. Higher scores indicated a better quality paper. To accommodate the heterogeneity of the studies under review and the varying levels of hierarchical evidence (i.e. single case studies and controlled designs) the maximal scores each study design could achieve were listed (see table 2) to ensure studies were assessed fairly. To allow comparison across the varied designs, a percentage score was then calculated.

Results and Data Synthesis

The synthesis of data related to the effectiveness of EMDR for addiction was complicated by the variances that exist between the studies, particularly the samples and methodologies employed. For this reason a meta-analysis was not attempted. These sources of heterogeneity are thus considered in turn, presented in a narrative manner (see table 2 for study summaries).

Sample Size

Of the 14 studies examined, sample sizes ranged from 1 to 89. The largest samples of 47, 50, and 89 were seen in the lab-based experimental studies that tested the use of bi-lateral stimulation only, to reduce the craving for food products and nicotine. The remaining 11 studies were conducted in real-world treatment settings with the highest sample of 30 among the controlled studies, however, once divided into experimental and comparative groups the resulting per-cell sample sizes were 15 or less. Kazdin (1994, p.47) states “power is commensurately reduced as the comparisons entail subgroups with small group ns”, this increases the likelihood of a type II error when conducting statistical analysis. Three authors acknowledged test power as a limitation of their study. Conversely, when the objective is to ascertain the greatest amount of knowledge on a chosen phenomenon both a representative case and a random sample may be the most suitable strategy (Flyvbjerg, 2006).

Protocols, Targets and Fidelity

With the exception of one (Meysami-Bonab, Abolghasemi, Sheikhan, Barahmand, & Rasooliazad, 2012), all of the investigators used manualised, replicable, and specific treatment protocols. The most common protocol employed was the standard EMDR protocol. All studies bar two demonstrated varying levels of improvement. Littel, van den Hout, and Engelhard, (2016) second study found no change in craving for the bilateral stimulation group which they attributed to an inadequate ‘craving induction’; however, craving could have also been contaminated because participants were satiated, having only requested 1 hour of abstinence before the study. Perez-Dandieu and Tapia (2014) partly attributed the absence of reduction in substance consumption to their employment of the standard protocol and sole focus on trauma targets. Hase, Schallmayer, and Sack (2008) has suggested the processing of the addiction memory (AM) may be independent from the processing of traumatic memories. They reached this preliminary conclusion because they did not observe any activation of traumatic memories during EMDR when processing the AM in participants with a trauma history. Bae & Kim (2012) demonstrated the success of the DeTUR protocol with an adolescent reporting internet addiction in as little as four sessions, which was maintained at the one-year follow-up. However, the participant’s addiction severity was determined as mild by the Internet Addiction Test which could have influenced treatment success. Miller (2012) proposes that the elimination of the feeling-state using the FSAP leads to the eradication of

the addiction, without the need of other behaviour management strategies. Miller's (2012) findings do support this idea which is further evidenced by three of the four participants having had previous addiction therapy without success, however, the findings are marred with a lack of follow-up and independent measurement on addiction. Abel and O'Brien (2010) were the only study to utilise a combination of three protocols, namely the DeTUR to install the participant's positive treatment goal, the standard EMDR protocol to reprocess earlier traumata, and the CravEx to reprocess the AM following a relapse in therapy. Whether this sequence of protocols would be effective for other addicted patients remains uncertain. Conversely, Kullack and Laugharne (2016) demonstrated concurrent improvements in patients' chemical addiction and PTSD symptomatology without modifying the standard EMDR protocol, and improvement was sustained at a 12 month follow-up. The two lab-based experiments demonstrated reduction in substance cravings utilising bilateral stimulation only (first study of Littel et al., (2016) paper). However, the authors suggested that short recall and eye movements would be insufficient to result in therapeutic effects and replications of the study with the 'full EMDR procedure' would be needed to assess the longevity of effects and impact on relapse. The lack of uniformity among studies is further compounded by insufficient treatment fidelity which is a widespread criticism of EMDR research more generally (Shapiro, 1999). Only one study (Rougemont-Bucking et al., 2012) demonstrated treatment adherence using independent monitoring, this leaves all the other studies open to therapist drift which could impede the EMDR treatment and replicability of findings. In addition, therapist training level was only partially reported by two studies.

Addiction Focus

Addictions under investigation ranged from pathological gambling to internet addiction, to drug dependency. However, only eight studies provided the average addiction duration of participants, and only seven utilised adequate measures to assess addiction severity at baseline. Moreover, Miller (2012) provided no information on how his participants had been assessed to achieve descriptors such as 'socialising compulsion' or 'a compulsion to degrade women', or how these compulsions had qualified as addictions. Such variables are important to consider. For newly addicted individuals the memories targeted in EMDR treatment for either protocol may not play a significant part (yet) in the maintenance of their addiction. Likewise, less severely addicted participants may demonstrate rapidity of

improvement inflating the efficacy of EMDR, or their improvement may be in smaller increments and more challenging to measure, effectively minimising efficacy and creating a potential bias (Maxfield & Hyer, 2002). Furthermore, seven of the studies facilitated standard care alongside EMDR as an experimental treatment, five provided EMDR alone, and two studies were lab-based experiments. Although it has been recommended by many that EMDR should be integrated into addiction treatment as an adjunctive therapy (O'Brien & Abel, 2011; Shapiro et al., 1994), it provides a challenge in research when attempting to discern the effects of EMDR from other treatment modalities, and can obscure true effects by diminishing construct validity (Maxfield & Hyer, 2002).

Sessions

Excluding the lab-based studies EMDR treatment ranged from 2 sessions to 2 years, although it is unclear how many sessions during the 2 year period were devoted to EMDR therapy (Abel & O'Brien, 2010). The variable length of EMDR treatment is problematic when attempting to define a minimum effective dosing level with the addiction population. Hase et al. (2008) offered three sessions to the first three participants receiving EMDR, the result was a strong reduction in the obsessive-compulsive drinking. Therefore, the sessions were cut to two which yielded similarly impressive results which were maintained at the one month follow-up. Perez-Dandieu and Tapia (2014) provided 8 sessions of EMDR which yielded no reduction of substance consumption; however, the time in-between sessions was longer (i.e. five sessions once monthly). Notably, in the studies where number of treatment sessions was not predefined and was determined by treatment success, the mean number of treatment sessions ranged from two sessions per participant for pathological gambling (Henry, 1996), to twenty-three months for a participant with long-standing drug addiction (Rougemon-Bucking et al., 2012). The optimal number of EMDR sessions for this patient group has yet to be empirically determined, yet this is also true of EMDR more generally (Hertlein & Ricci, 2004). However, insufficient treatment sessions is likely to interfere with good assessment of efficacy.

Measurement Strategy

Seven studies achieved the maximal rating for using reliable and valid measures which were adequate to measure change in the variable of interest. Other assessed outcomes included measures of distress, dissociation, and emotionality and vividness of addiction-related imagery. Moreover, only six studies utilised addiction specific validated instruments to detect measurable changes of addiction symptoms in response to EMDR treatment, yet only three studies acknowledge this as a limitation (Kullack & Laugharne, 2016; Miller, 2010; 2012). A number of studies determined participant sobriety at the end of the treatment purely by self-report which are susceptible to relational artifacts. Three case studies only utilised subjective measurements which are part of the respective EMDR treatment protocol (i.e. Validity of Cognition; Level of Urge) yet such measures are highly vulnerable to demand characteristics and the researcher's subjective and arbitrary judgements. The use of multi-modal measures indicate a commitment to methodological rigor (Hertlein & Ricci, 2004), four studies included an interview measure and four studies employed behavioural and/or physiological measures in addition to self-report, namely 'the snack test' (Littel et al., 2016) 'the smoking test' (Markus, van-Oene, Woud, Becker, & Dejong, 2016), skin conductance levels (Miller, 2012), and facial recognition (Meysami-Bonab et al., 2012). A smokelyzer was utilised in the two lab-based studies, but only to check compliance to the study instructions prohibiting smoking one to eight hours before the experiment. A collective drawback of all the applicable studies was the absence of an independent assessor. The lack of a non-treating assessor to administer and collect data introduces outcome bias, as the therapeutic alliance may influence participant responding. This was illustrated in Rougemont-Bucking and Zimmerman (2012) who questioned whether a participants rapid stabilisation in craving and drug use upon resuming therapy, was due to the re-establishment of the therapeutic relationship or ensuing EMDR treatment.

Control Group and Effect Sizes

Six studies adopt a pre- and post-design, three include a control group and three include a comparison group. When conducting controlled research looking at whether an intervention produces a treatment change, a basic requirement is the inclusion of a control or comparison group (Hertlein & Ricci, 2004). Unlike a control group comparison groups can become problematic if participants are taken from a treatment milieu, like Hase et al. (2008)

sample who were recruited from a psychiatric inpatient setting, and were engaged in concurrent psychotherapy. A reason for this is the possible system-wide influences that participants are exposed to, in addition to experimenter expectancies particularly if it is the same treating clinician for both control and experimental groups (Isaac & Michael, 1995). All of the controlled studies excluding Henry (1996) and Littel et al. (2016) employed some form of randomisation to assign participants to the aforesaid groups. Henry (1996) experimental group were determined by self-selection, suggesting differences in participant motivation between groups which could have led to superior outcomes for the EMDR group even if treatment was ineffective. Motivational differences were further magnified by the inconsistent therapy received by the comparison group which was largely dependent on participant engagement.

Five of the six controlled studies available were characterised by significant effects and generally high effect sizes compared to control and comparison groups. The individual study effect sizes ranged from .03 to -.68. Meysami-Bonab et al. (2012) achieved the highest effect sizes favouring improvements in the EMDR experimental group on both the emotion regulation measure and the emotion recognition task. Although the author hypothesised that emotional dysregulation when encountering stressful life events is a causal factor in the onset, maintenance, and relapse of addiction, without the inclusion of an addictive measure we are unable to test whether improved emotional regulation and recognition leads to concurrent improvement in addictive symptomatology. Perez-Dandieu and Tapia (2014) found no significant differences from pre- and posttreatment comparisons, however, when we conducted effect size calculations a medium effect size was achieved favouring improvement in the EMDR group. Statistical significance may not have been achieved due to the small sample size ($N = 12$). The overall quality percentages assigned to each of the controlled studies ranged from 15% to 78% indicating variable standards of methodological rigour. Arguably better methodology across the studies would be more likely to reveal true effects. Conversely, upon closer examination there was no strong trend for lower or higher effect sizes among studies of a higher or lower quality rating. Furthermore, a cross-study comparison is flawed due to cross-study methodological heterogeneity, meaning it is difficult to discern any patterns in treatment success or failure due to diverse study characteristics.

Abstinent Requirement

Active substance abuse has often been considered to be an exclusion criteria for therapy, including EMDR (Shapiro, 2001), yet this criteria is typically based on clinical observation and opinion, and not scientific evidence of which there currently is none (Clarkin & Levy, 2004; Franklin, 2015). Nine of the studies accepted participants who were known to be actively engaged in their respective addiction prior to, and during the onset of therapy, and all but one suggest EMDR therapy can lead to favourable outcomes for patients who have not yet obtained sobriety. Furthermore, two studies demonstrated that relapse in therapy is relatively inconsequential to treatment outcomes if the relapse remains within the participant's habitual coping mechanisms and is not associated with inflated health risks (Abel & O'Brien, 2010; Rougemont-Bucking et al., 2012). Both authors suggested this could be a 'normal' experience in the progression to sobriety or harm reduction. Four studies requested some degree of abstinence, however, two of these studies were laboratory based and participants were asked to abstain from smoking one to eight hours before the experiment to minimise contamination when completing the craving measure. A further study specified continual use of cocaine or heroin as an exclusion criteria, yet achieved no significant changes to other drug consumption in either the EMDR or comparison group. Hase et al. (2008) required complete participant abstinence and focused reprocessing on the AM which manifests consciously as intense craving; therefore, abstinence was a prerequisite to enable assessment of craving. Craving did decrease along with experiences of relapse at the one- and six-month follow-ups in the EMDR group only, suggesting the AM may qualify as a maladaptive memory within the AIP model. Noteworthy is 83% of participants at the end of the study were considered relapsed. Although this figure encompassed non-responders who may or may not have sustained sobriety, it raises a question whether the prerequisite of abstinence before undertaking EMDR therapy is a feasible ask of addicted individuals, and actually results in better treatment outcomes.

Table 2

General characteristics and key findings

First author/ Date/ Place	Methodology	EMDR Protocol and Targets	Sample characteristics	Assessed Outcomes	Is abstinence a requirement for therapy?	Summary points and Key Findings	Effect size Cohens' d
Henry 1996 USA	Quasi- experimental: Non-equivalent Groups Design Intervention: Experimental group received EMDR adjunct with treatment as usual (TAU) (standard cognitively orientated psychotherapy) which was provided before and after the EMDR intervention. Waiting list control	Protocol: Standard EMDR protocol Targets: Trauma targets, past experiences or disturbing current events. Occasionally gambling associations appeared spontaneously. Number of sessions: Variable (mean: 2, range: 1-4 sessions) Length of sessions: Variable (mean:	Addiction focus: Pathological gambling Addiction duration: Not reported Total participants: 22 Gender: 8 female, 14 male Age Range: 19- 62 years Mean age: 38 years Study groups: Group not receiving EMDR, (WOE; N =12, female = 6, male = 6)	Outcome measure of interest: GEF* pre-and-post for WE group, ongoing count reported for WOE group. Other: SOGS used to determine gambling severity, alongside DSM- IV* criteria for pathological gambling. Follow-up: None reported	No – participants engaged in pathological gambling behaviour prior to and during the intervention.	No significant differences in GEF between WE and WOE prior to EMDR. For WE group, GEF decreases significantly from pre- to post- EMDR, indicating a significant effect of EMDR on GEF. For a subset of WOE participants (N = 7), an examination of an artificial “post” break (after a	1.73* Large within group effect

First author/ Date/ Place	Methodology	EMDR Protocol and Targets	Sample characteristics	Assessed Outcomes	Is abstinence a requirement for therapy?	Summary points and Key Findings	Effect size Cohens' d
	represented a delayed treatment group who received TAU during the study.	1.5 hours, range: 30 minutes to 2 hours) Bilateral stimulation: Eye movements	Group receiving EMDR (WE; N = 10, female = 2, male = 8), one EMDR participant recruited did not have a trauma history. SOGS* scores (mean: 15.5, SD = 10.4), no significant difference between groups. Comorbidity: 55% of participants have alcohol and/or drug diagnosis, including other co-morbid conditions (i.e. depression)			minimum of 2.6 months in therapy) found an increase in GEF compared to pre- therapy scores.	

First author/ Date/ Place	Methodology	EMDR Protocol and Targets	Sample characteristics	Assessed Outcomes	Is abstinence a requirement for therapy?	Summary points and Key Findings	Effect size Cohens' d
Cox 2007 USA	Case study Intervention: EMDR alongside weekly attendance at 12-step group (structured support group with others experiencing addiction). The author incorporated empty-chair work, letter-writing, and relapse-prevention (CBT) in the participants overall treatment plan, however, it is unclear when in treatment these strategies were employed.	Protocol: Standard EMDR protocol Targets: Traumatic memories originating from childhood abuse. Number of sessions: 15 to date, however, treatment ongoing (EMDR introduced at session 6). Length of sessions: Not reported Bilateral Stimulation: Not reported	Addiction focus: Sexual addiction Addiction duration: The author provides a timeline of the participant's sexually explicit behaviour commencing age 3 when subjected to abuse, however, it is unclear when the participant's behaviour escalated from explorative to sexually addictive behaviour as an adolescence. Total participants: 1 Gender: Male Age: 21 years	Outcome measure of interest: SUDs* and VoCs* Other: Sexual Dependency Inventory completed during the initial sessions to develop the participants sexual arousal template. Follow up: None (treatment ongoing)	No – participant engaged in sexually addictive behaviour prior to and during treatment.	SUDs had reduced from 9 to 0 towards the end of treatment (<i>session numbers not stated</i>). Similarly, VoCs increased from a 2 to a 7 when accessing traumatic images. The author did not explicitly report what impact EMDR therapy had provided on the participants sexual addiction (i.e. change in frequency of addictive behaviours), but made some reference to a	N/A*

First author/ Date/ Place	Methodology	EMDR Protocol and Targets	Sample characteristics	Assessed Outcomes	Is abstinence a requirement for therapy?	Summary points and Key Findings	Effect size Cohens' d
			Comorbidity: A history of mild depression and pharmacological use is reported; however, it is not clear if this is current.			greater number of relapses at the beginning of therapy (e.g. calling phone-sex lines) which were used for subsequent processing and relapse prevention planning.	

First author/ Date/ Place	Methodology	EMDR Protocol and Targets	Sample characteristics	Assessed Outcomes	Is abstinence a requirement for therapy?	Summary points and Key Findings	Effect size Cohens' d
Hase 2008 Germany	Randomised Control Trial Intervention: Experimental group received EMDR adjunct with TAU (detoxification from alcohol, motivational interviewing, assessment of social status and functioning, addiction-focused group therapy, relaxation, art therapy and participation in 12 steps group following detoxification). Comparative group TAU only, both groups	Protocol: CravEx protocol Targets: Memory of last craving/urge or relapse. Number of sessions: 2 (first 3 participants received 3 sessions of EMDR, however, due to a marked reduction in the OCDS* scores, EMDR sessions were cut to 2 for remaining participants). Length of sessions: 60 minutes	Addiction focus: Alcohol addiction Addiction duration: Average 12.1 years in the TAU and 10.7 years in the TAU+EMDR group. Total participants: 34 inpatients seeking detoxification treatment in a German regional Psychiatric hospital. (Two dropped out and two were excluded for ongoing drug abuse) Gender: 12 female, 18 male	Outcome measure of interest: OCDS* Other: ICD-10* criterion for alcohol dependence, MALT*, Mini- DIPS*, PTSS- 10*, DES*, SDQ-5*, BDI*, STAI*. Follow-up: 1 month and 6 months posttreatment.	Yes – exclusion criteria included continuous use of any drug of abuse in treatment. Conversely, a history of multiple drug use did not lead to a participant's exclusion.	Pre-treatment OCDS scores did not significantly differ in the TAU+EMDR group compared to TAU. Posttreatment scores of OCDS revealed a significant improvement in the TAU+EMDR treatment group. Only a small reduction in OCDS was observed in the TAU group. The difference in OCDS posttreatment scores between TAU+EMDR and TAU was	

First author/ Date/ Place	Methodology	EMDR Protocol and Targets	Sample characteristics	Assessed Outcomes	Is abstinence a requirement for therapy?	Summary points and Key Findings	Effect size Cohens' d
	treatment lasted 2-3 weeks. For participants with co-morbid psychiatric difficulties further support was offered, including pharmacology although no further details were reported.	Bilateral stimulation: Not reported	Age range: Not reported Mean age: Not reported Study groups: TAU (N = 15, female = 5, male = 10) TAU+EMDR (N = 15, female = 7, male = 8). Comorbidity: TAU (N = 10), diagnoses included but were not limited to panic disorder, borderline personality disorder (BPD), and adjustment disorder. TAU+EMDR (N = 12), diagnoses included but were			statistically significant, favouring improvement in TAU+EMDR group. <i>1 Month Follow-up (24 participants responded)</i> TAU+EMDR treatment group demonstrated a significant reduction in OCDS scores compared to pre-treatment, even when the OCDS measured 4.2 points higher than the posttreatment scores.	0.87*** Large within group effect

First author/ Date/ Place	Methodology	EMDR Protocol and Targets	Sample characteristics	Assessed Outcomes	Is abstinence a requirement for therapy?	Summary points and Key Findings	Effect size Cohens' d
			not limited to mild, moderate, and severe depressive disorder, BPD, and adjustment disorder.			Between group differences in OCDS scores posttreatment at 1 month follow-up were also statistically significant, favouring greater improvement in TAU+EMDR group. <i>6 Month Follow- up (8 participants responded)</i> Statistical evaluation of OCDS scores was not possible due small amount of data available. TAU (N = 15, relapsed or failed to report),	

First author/ Date/ Place	Methodology	EMDR Protocol and Targets	Sample characteristics	Assessed Outcomes	Is abstinence a requirement for therapy?	Summary points and Key Findings	Effect size Cohens' d
						EMDR+TAU (N = 10, relapsed or failed to report). Fisher's exact test revealed a statistically significant difference between the treatment groups regarding relapse.	

First author/ Date/ Place	Methodology	EMDR Protocol and Targets	Sample characteristics	Assessed Outcomes	Is abstinence a requirement for therapy?	Summary points and Key Findings	Effect size Cohens' d
Abel 2010 USA	Case study Intervention: EMDR and 'recovery techniques' used before and during EMDR, namely attendance at Alcohol Anonymous meetings, affect management techniques, identification of triggers for use, and development of techniques to manage cravings. Therapy following EMDR focused on past family issues and current relationship problems.	Protocol: DeTUR, standard EMDR protocol, and CravEx. Targets: 'Positive treatment goal' installation, trauma memory of husband's suicide, and AM following relapse in therapy. Number of sessions: Not clear, narrative indicates > 2 year duration. Length of sessions: Not reported Bilateral stimulation:	Addiction focus: Alcohol addiction Addiction duration: Unclear, although from the narrative provided it appears the participant has engaged in addictive drinking sporadically throughout adulthood. Total participants: 1 Gender: Female Age: 45 years Comorbidity: Depression, anxiety, and PTSD symptomatology.	Outcome measure of interest: SUDs, VoCs, and LOU* Other: None reported Follow-up: Two years (The follow-up is two years post-EMDR therapy, but actually conducted at the immediate ending of the participants therapy work, as opposed to two- year post- psychological treatment).	No – the participant was accepted for therapy despite persistent and problematic consumption of alcohol at the beginning of therapy; however, the participant was not deemed 'physically dependant' and remained highly functioning.	During trauma processing, participant's SUDs reduced from 10 to 0 by the 3 rd session using the standard EMDR protocol. Similarly the starting VoC rating was 3 and at the end of the 3 rd session the participant's positive cognition was deemed installed, however, the final VoC score was not reported. Following relapse, the CravEx protocol was utilised. Participants	N/A

First author/ Date/ Place	Methodology	EMDR Protocol and Targets	Sample characteristics	Assessed Outcomes	Is abstinence a requirement for therapy?	Summary points and Key Findings	Effect size Cohens' d
		Audiotac and tappers				starting LOU was 10 this reduced to 0 at the end of one session of processing. The starting VoC was 4 and this was considered 'installed' at the end of the session. The protocol was utilised a further four times in subsequent sessions to process cravings and urges to relapse with similar success. <i>2 Year Follow-up</i> The participant had maintained sobriety for two years at the time	

First author/ Date/ Place	Methodology	EMDR Protocol and Targets	Sample characteristics	Assessed Outcomes	Is abstinence a requirement for therapy?	Summary points and Key Findings	Effect size Cohens' d
						<p>this case study was written; however, sobriety was observed while the participant was still attending therapy. Therefore, it is unclear whether this treatment outcome will be maintained beyond the termination of therapy.</p>	

First author/ Date/ Place	Methodology	EMDR Protocol and Targets	Sample characteristics	Assessed Outcomes	Is abstinence a requirement for therapy?	Summary points and Key Findings	Effect size Cohens' d
Miller 2010 USA	Case study Intervention: EMDR only	Protocol: Impulse-Control Disorder protocol (ICDP; since renamed FSAP). Targets: Positive feeling states and negative beliefs associated with gambling behaviour. Number of sessions: 5 Length of sessions: Not reported Bilateral stimulation: Eye movements	Addiction focus: Pathological gambling Addiction duration: Minimum of 10 years Total participants: 1 Gender: Male Age: 35 years Comorbidity: None reported	Outcome measure of interest: PFS*, SUDs, and VoCs. Other: Participants self-reported changes in their addictive behaviour. Follow-up: 3 months posttreatment	No – The participant was required to play poker for homework to note any changes in behaviour and feeling.	At the first session the participant's PFS were 10 when recalling a 'win' whilst gambling, after three sets of eye movements the PFS dropped to 2. This pattern continued at each session when processing the positive feeling state attached to memories or conjured images of gambling. The participant was encouraged to identify negative beliefs associated with gambling i.e. "I am a loser"	N/A

First author/ Date/ Place	Methodology	EMDR Protocol and Targets	Sample characteristics	Assessed Outcomes	Is abstinence a requirement for therapy?	Summary points and Key Findings	Effect size Cohens' d
						underlying the feeling state "I am winning". For the first belief identified the participant provided a SUD rating of 9, after processing this reduced to 1. The VoC rating for the positive belief installed increased from 2 to 7. Again, this pattern of scores proceeded for the remaining processing sessions. At the end of the final session the participant's gambling was reported as	

First author/ Date/ Place	Methodology	EMDR Protocol and Targets	Sample characteristics	Assessed Outcomes	Is abstinence a requirement for therapy?	Summary points and Key Findings	Effect size Cohens' d
						<p>reducing from 40 or more hours per week to less than 8. Qualitatively, the participant reported a different experience when gambling i.e. he no longer chased losing hands and was able to leave the table after a couple of hours whether he had won or lost. However, neither of these outcomes were captured by a standardised measurement.</p>	

First author/ Date/ Place	Methodology	EMDR Protocol and Targets	Sample characteristics	Assessed Outcomes	Is abstinence a requirement for therapy?	Summary points and Key Findings	Effect size Cohens' d
						<p><i>3 Month Follow-up</i></p> <p>Conducted via telephone, the participant reported his gambling compulsion had not returned, and he continued to enjoy poker nights twice a week only. No objective measurements were taken.</p>	

First author/ Date/ Place	Methodology	EMDR Protocol and Targets	Sample characteristics	Assessed Outcomes	Is abstinence a requirement for therapy?	Summary points and Key Findings	Effect size Cohens' d
Miller 2012 USA	Multiple baseline design Intervention: EMDR only	Protocol: FSAP Target: Feeling states and negative beliefs associated with addictive behaviour. Number of sessions: Unclear, a range of 23-30 sessions was reported, however, this included separate sessions required for measurement readings and the intervention. An average treatment period of 2 weeks was reported to	Addiction focus: Participants had two behavioural addictions each: Participant 1 – Impersonating a policeman and a sexual compulsion. Participant 2 – A sexual compulsion and degrading conduct against women. Participant 3 – Pathological gambling and a socialising compulsion. Participant 4 – Pathological gambling and sex addiction.	Outcome measure of interest: SCLs* and PFS Other: Participants self-reported changes in their addictive behaviour Follow-up: None reported	No – participants engaged in addictive behaviour prior to and during treatment.	Five baseline measures were obtained for behavioural addictions (SCLs and PFS). The measures were taken again posttreatment after each behavioural addiction had been targeted for processing. A change in participant's reactivity toward their addictive behaviour was witnessed by the reduction in the aforementioned measures after each behaviour was targeted	N/A

First author/ Date/ Place	Methodology	EMDR Protocol and Targets	Sample characteristics	Assessed Outcomes	Is abstinence a requirement for therapy?	Summary points and Key Findings	Effect size Cohens' d
		complete an intervention for one compulsion, however, it is again unclear how regular the sessions were as the author only made reference to the variable length between sessions as being something they were unable to control. Length of sessions: Not reported Bilateral stimulation: Eye movements	Addiction duration: Not reported Total participants: 4 Gender: Male Age: Participant 1 – 24 years Participant 2 – 25 years Participant 3 – 41 years Participant 4 – 35 years Comorbidity: None reported			(Illustrated through visual analysis). A reduction in scores indicated the intervention was successful. Moreover, participants qualitatively reported a change in their behaviour from pathological to “normal” (i.e. for one participant his previous compulsion to ascertain multiple women’s phone numbers and ‘hunt’ for sexual conquests dissipated and he was able to	

First author/ Date/ Place	Methodology	EMDR Protocol and Targets	Sample characteristics	Assessed Outcomes	Is abstinence a requirement for therapy?	Summary points and Key Findings	Effect size Cohens' d
						<p>maintain a monogamous relationship), this occurred for all participants within days of their feeling-states being processed.</p> <p>*One participant's massage parlour compulsion did not follow the same reduction in scores following intervention. This was attributed to the participant's daily attendance at a massage parlour which left him feeling 'satisfied' and, therefore,</p>	

First author/ Date/ Place	Methodology	EMDR Protocol and Targets	Sample characteristics	Assessed Outcomes	Is abstinence a requirement for therapy?	Summary points and Key Findings	Effect size Cohens' d
						visualising the addictive behaviour was not arousing for him which affected the SCLs and PFS measurements.	

First author/ Date/ Place	Methodology	EMDR Protocol and Targets	Sample characteristics	Assessed Outcomes	Is abstinence a requirement for therapy?	Summary points and Key Findings	Effect size Cohens' d
Bae 2012 South Korea	Case study Intervention: EMDR only	Protocol: DeTUR protocol Targets: Triggers to addictive behaviours (i.e. A computer class, sitting in front of a PC). Number of sessions: 4 weekly Length of sessions: 45 minutes Bilateral stimulation: Vibrational tactile stimulation	Addiction focus: Internet addiction Addiction duration: 4 years, using internet gaming for five hours per day. Total participants: 1 Gender: Male Age: 13 years Comorbidity: Moderate depressive symptoms	Outcome measure of interest: IAD* test (Korean version) Other: Goldberg's criterion for IAD, LOU, BDI Follow-up: 2 weeks, 6 months, and 1 year posttreatment	No – participant engaged in addictive behaviour prior to and during treatment.	Pre-treatment the participant scored 75 on the IAD test (cut-off value 70), posttreatment at the 2-week follow-up he scored 38. Reduction in time spent gaming from 5 hours a day to 1 hour, however, was assisted by time- limiting software at home which disconnected him from the internet after 1 hour. At 6 months and 1-year follow-up therapeutic gains were maintained. At 1 year follow up participant had	N/A

First author/ Date/ Place	Methodology	EMDR Protocol and Targets	Sample characteristics	Assessed Outcomes	Is abstinence a requirement for therapy?	Summary points and Key Findings	Effect size Cohens' d
						stopped playing the online game altogether that had formed his addiction. Current internet use included emailing, completing homework, and occasionally playing games but without PC control.	

First author/ Date/ Place	Methodology	EMDR Protocol and Targets	Sample characteristics	Assessed Outcomes	Is abstinence a requirement for therapy?	Summary points and Key Findings	Effect size Cohens' d
Rougemont- Bucking 2012 Switzerland	Two single case studies presented Intervention: EMDR alongside 'psychosocial supportive treatment' conducted by a designated social worker. Bi- monthly, collaborative sessions with the participant, social worker, and EMDR practitioner were facilitated.	Protocol: Standard EMDR protocol Targets: Past trauma memories Number of sessions: <i>Participant 1</i> – weekly sessions, approx. 23 months duration (after 10 months of treatment, a 13 month break commenced due to the therapists sabbatical leave before resuming therapy) <i>Participant 2</i> – weekly sessions, 10 months duration.	Addiction focus: Drug addiction, namely midazolam and heroin Addiction duration: <i>Participant 1</i> – Drug abuse commenced age 15, dependence on heroin from age 30. Abstinent from heroin when commencing therapy but illegally consuming midazolam, smoking cannabis and drinking alcohol daily. The participant was also enrolled in a methadone	Outcome measure of interest: 3 item cocaine craving scale (converted to 'drug of choice' for each participant) Other: DES, IES-R*, SDQ-5 & SDQ-20, SUD. Follow-up: Due to the therapists sabbatical leave this afforded a follow-up of 13 – 14 months posttreatment when the therapist returned.	No – participants were known to have active ongoing drug abuse.	<i>Participant 1</i> – Cannabis/alcohol use remained at the habitual level. The participant became abstinent from the midazolam although it is unclear at what stage of therapy this occurred. At baseline the participant's craving score was 13 indicating severe craving. After the first treatment session the craving score reduced and remained in the ranges of non- clinical and mild craving, returning	N/A

First author/ Date/ Place	Methodology	EMDR Protocol and Targets	Sample characteristics	Assessed Outcomes	Is abstinence a requirement for therapy?	Summary points and Key Findings	Effect size Cohens' d
		Length of sessions: 50 - 90 minutes Bilateral stimulation: Eye movements	maintenance treatment programme which had commenced four years prior to entering therapy. <i>Participant 2</i> – Drug abuse commenced age 16, consuming heroin intermittently since the age of 20. When beginning therapy consumption occurred two to three times per month. A methadone treatment plan alongside psychosocial counselling was initiated 32			to a moderate when resuming therapy. However similarly, after the first session the scores reduced and remained in the non-clinical and mild range until treatment termination. During the 13 month break the participant restarted his consumption of midazolam and episodic heroin use. The participant had engaged in 16 months of stabilisation and resource building	

First author/ Date/ Place	Methodology	EMDR Protocol and Targets	Sample characteristics	Assessed Outcomes	Is abstinence a requirement for therapy?	Summary points and Key Findings	Effect size Cohens' d
			<p>months prior to therapy.</p> <p>Total participants: 2</p> <p>Gender: Male</p> <p>Age:</p> <p>Participant 1 – 53 years</p> <p>Participant 2 – 36 years</p> <p>Co-morbidity:</p> <p>Participant 1 – Complex PTSD</p> <p>Participant 2 – BPD</p>			<p>before the standard EMDR protocol was introduced (after the break). The participant chose to ‘put the therapy on hold’, after approx. 5 months of resuming although the reasons for this are unclear.</p> <p>Participant 2 – Consumed heroin once or twice a month and his baseline craving score was 17 indicating severe craving. A period of three months was dedicated to resource building</p>	

First author/ Date/ Place	Methodology	EMDR Protocol and Targets	Sample characteristics	Assessed Outcomes	Is abstinence a requirement for therapy?	Summary points and Key Findings	Effect size Cohens' d
						before the introduction of 'standard EMDR'. During the trauma reprocessing the participant demonstrated negative signs of dissociation and on one occasion this led to the participant declaring a strong urge to consume heroin. The participant disclosed at the consequent session that he had 'sniffed' some heroin. The participant's lowest craving scores	

First author/ Date/ Place	Methodology	EMDR Protocol and Targets	Sample characteristics	Assessed Outcomes	Is abstinence a requirement for therapy?	Summary points and Key Findings	Effect size Cohens' d
						demonstrating mild craving was at the last session before the break in therapy. At the 14 month follow- up the participant had reported remaining abstinent from heroin for four months posttreatment, but had since resumed his habitual consumption of heroin. His craving score (14) had returned to the severe range, however, he declined to engage in further therapy due to a	

First author/ Date/ Place	Methodology	EMDR Protocol and Targets	Sample characteristics	Assessed Outcomes	Is abstinence a requirement for therapy?	Summary points and Key Findings	Effect size Cohens' d
						change in his personal circumstances.	

First author/ Date/ Place	Methodology	EMDR Protocol and Targets	Sample characteristics	Assessed Outcomes	Is abstinence a requirement for therapy?	Summary points and Key Findings	Effect size Cohens' d
		Length of sessions: 60 minutes Bilateral stimulation: Eye movement				The experimental group also experienced a significant increase in emotion recognition rates comparative to the control group.	5.78*** Large between group effect

First author/ Date/ Place	Methodology	EMDR Protocol and Targets	Sample characteristics	Assessed Outcomes	Is abstinence a requirement for therapy?	Summary points and Key Findings	Effect size Cohens' d
Perez-Danfieu 2014 France	A pilot study: Pre-post design Intervention: Experimental group participated in TAU and EMDR, and comparative group engaged in TAU only. TAU included clinical interviews with the addiction specialist, pharmacological treatment for alcohol/drug cravings, and anxiety/ PTSD symptomatology, and psycho-educational interviews with social workers.	Protocol: Standard EMDR protocol Targets: Trauma memories Number of sessions: 8 sessions over 6 months (In the first month participants attended three sessions and thereafter one session per month). Length of sessions: Not reported Bilateral stimulation: Eye movements	Addiction focus: Drug and/ or alcohol addiction. Addiction duration: Not reported Total participants: 12 Gender: Women Age range: Not reported Mean age: Not reported Study groups: TAU (N = 6) TAU+EMDR (N = 6) Comorbidity: Depression and anxiety were assessed as part of measurement strategy.	Outcome measure of interest: ASL* Other: PCL-S*, DSM-IV diagnostic criteria for substance dependence and PTSD, BDI, SEI*, and the TAS-20*. Follow-up: None reported	Partially – participants who reported continuous use of heroin or cocaine specifically were excluded. The rationale for this was not provided	Pre-treatment and posttreatment comparisons of the ASL score show neither the TAU+EMDR group nor the TAU group demonstrated a reduction in alcohol or substance addiction, and there was no significant difference of the ASL scores between the groups posttreatment.	0.65 Medium between group effect favouring improvement in TAU+EMDR group

First author/ Date/ Place	Methodology	EMDR Protocol and Targets	Sample characteristics	Assessed Outcomes	Is abstinence a requirement for therapy?	Summary points and Key Findings	Effect size Cohens' d
Bae 2015 South Korea	Case series Intervention: EMDR alongside TAU (10-week group-based program that includes CBT, motivation enhancement, lectures, psychodrama, meditation, and Gamblers Anonymous).	Protocol: DeTUR protocol Targets: Triggers and urges to addictive behaviours Number of sessions: 3 Length of sessions: 60 minutes Bilateral stimulation: Not reported	Addiction focus: Pathological gambling Addiction duration: Participant 1 – 'several years' Participant 2 – 10 years Participant 3 – 10 years Participant 4 – Not reported Total participants: 4 inpatients from an Addiction Treatment and Rehabilitation Psychiatric Hospital. Gender Male Age: Participant 1 – 47 years	Outcome measure of interest: G- SAS* and BIS- 11* Other: Self- Rating Depression Scale, Self- Rating Anxiety Scale, and LOU. Follow-up: 6 months posttreatment	No – however, due to the treatment setting (psychiatric hospital) participants were unable to access gambling stimuli.	Visual analysis was used to illustrate the findings. At the end of the EMDR sessions (TAU continued) all participants were subclinical on the G-SAS. <i>6 Month Follow- up</i> All participants maintained therapeutic gains achieved at the end of the EMDR intervention and were subclinical on G-SAS. Also, all participants reported abstinence, despite this not	N/A

First author/ Date/ Place	Methodology	EMDR Protocol and Targets	Sample characteristics	Assessed Outcomes	Is abstinence a requirement for therapy?	Summary points and Key Findings	Effect size Cohens' d
			Participant 2 – 53 years Participant 3 – 52 years Participant 4 – 34 years Comorbidity: None reported			being required for the DeTUR protocol. Impulsiveness symptoms changed the least, this was attributed to the DeTUR protocol which focuses on the urge associated with specific triggers and not the impulsiveness trait.	

First author/ Date/ Place	Methodology	EMDR Protocol and Targets	Sample characteristics	Assessed Outcomes	Is abstinence a requirement for therapy?	Summary points and Key Findings	Effect size Cohens' d
Littel 2016 Netherlands Study 1	Two proof-of-principle studies presented: Pre- and post-test lab based design Intervention: Participants recall food-related imagery whilst receiving bilateral stimulation or while maintaining stationary eyes (recall only).	Protocol: Bilateral stimulation only (EMDR lab model) Targets: Food-related mental imagery Number of sessions: 1 Length of sessions: Four intervals of 24 seconds bilateral stimulation separated by 10 second breaks. Bilateral stimulation: Eye movements initiated from side-to-side movements by a white dot	Addiction focus: Food craving Addiction duration: N/A Total participants: 89 Gender: Female Age range: Not reported Mean age: 21.5 years Study groups: Dieters (N = 42) and Non-Dieters (N = 47) assigned both to Recall & eye movement (EM) (N = 45) or Recall only (RO) (N = 45) Comorbidity: Not reported	Outcome measure of interest: Craving VAS*, G-FCQ-S*, and a behavioural task (snack choice; apple or candy bar). Other: G-FCQ-T*, Vividness VAS, and Emotionality VAS. Follow-up: None reported	N/A	Recall and EM group showed a significant reduction in craving for the target food from pre- to post-test. RO group showed a trend for craving increasing for the target food from pre- to post-test. RO group G-FCQ-S scores significantly increased from pre- to post-test. Recall and EM group G-FCQ-S scores remained stable over time.	0.51* Medium within group effect 0.42 Small within group effect 0.71** Medium within group effect

First author/ Date/ Place	Methodology	EMDR Protocol and Targets	Sample characteristics	Assessed Outcomes	Is abstinence a requirement for therapy?	Summary points and Key Findings	Effect size Cohens' d
		presented on a black screen.				Recall and EM group were more likely to select the healthier snack choice and this was considered greater than chance alone, suggesting EMs during recall of food- related images can affect subsequent behavioural choices.	0.04 Minimal within group effect

First author/ Date/ Place	Methodology	EMDR Protocol and Targets	Sample characteristics	Assessed Outcomes	Is abstinence a requirement for therapy?	Summary points and Key Findings	Effect size Cohens' d
Littel 2016 Netherlands continued Study 2	Intervention: Participants recall smoking-related memories whilst receiving bilateral stimulation or while maintaining stationary eyes (recall only).	Protocol: Bilateral stimulation only (EMDR lab model) Targets: Smoking-related mental imagery/ memories Number of sessions: 1 Length of sessions: Six intervals of 24 seconds bilateral stimulation separated by 10 second breaks. Bilateral stimulation: Horizontal eye movements initiated by a	Addiction focus: Nicotine addiction Addiction duration: Mean: 6.5 years; Quantity mean: 10.4 cigarettes per day. Mean nicotine dependence level: 2.0 (considered low, assessed by FTND*). Total participants: 50 Gender: Female 58% and male 42% of sample. Age range: Not reported Mean age: 23.4	Outcome measure of interest: Craving VAS and QSU*-brief. Other: FTND ³ , Vividness VAS, Emotionality VAS and a smokerlyzer Follow-up: None reported	Yes temporarily - participants were asked to refrain from smoking for a minimum of 1 hour prior to the experiment.	In the recall and EM group the craving scores remained constant over time. In the RO group, craving scores significantly increased from pre- to post-test. No significant effects were found for the QSU-brief pre- and post-test. This was attributed to an inadequate craving induction as the mean	0.26 Small within group effect 0.89** Large within group effect

³ FTND only collected once prior to experimental group assignment and, therefore, not an outcome of interest for this study.

First author/ Date/ Place	Methodology	EMDR Protocol and Targets	Sample characteristics	Assessed Outcomes	Is abstinence a requirement for therapy?	Summary points and Key Findings	Effect size Cohens' d
		white dot presented on a black screen.	years Study groups: Recall & EM (N = 25) Recall only (RO) (N = 25) *Gender spilt between groups not reported. Comorbidity: Not reported			QSU-brief scores after this induction were only 3.3 on a scale from 1-7 and, therefore, not maximal as intended prior to the experiment.	

First author/ Date/ Place	Methodology	EMDR Protocol and Targets	Sample characteristics	Assessed Outcomes	Is abstinence a requirement for therapy?	Summary points and Key Findings	Effect size Cohens' d
			group, EM+ (N = 24, female = 19, male = 5) Control group, fixed gaze EM- (N = 23, female = 11, male = 12) Comorbidity: Not reported	smoke if desired. Other: Smokelyzer, RCQ-D*, PANAS* Follow-up: 1 week post-test		baseline and follow-up for the EM+ group, and there was no significant difference in FTND scores between the EM+ and EM- group at follow-up.	0.03 Minimal within group effect
						The observational measure revealed a higher but non-significant proportion of the EM+ group did not smoke post-intervention.	0.10 Minimal between group effect
						<i>1 Week Follow-up</i> Therapeutic gains were not maintained for	

First author/ Date/ Place	Methodology	EMDR Protocol and Targets	Sample characteristics	Assessed Outcomes	Is abstinence a requirement for therapy?	Summary points and Key Findings	Effect size Cohens' d
						<p>craving, QSU-brief was not collected at follow-up.</p> <p>Results showed no significant difference between groups in craving ratings from post-trial to follow-up, and paradoxically there was a trend towards craving ratings increasing for the EM+ group.</p> <p>SCE was collected at baseline and follow-up only. Results showed no significant</p>	<p>0.43</p> <p>Small between group effect</p>

First author/ Date/ Place	Methodology	EMDR Protocol and Targets	Sample characteristics	Assessed Outcomes	Is abstinence a requirement for therapy?	Summary points and Key Findings	Effect size Cohens' d
						differences between follow- up SCE scores between the EM+ and EM- group.	0.33 Small between group effect

First author/ Date/ Place	Methodology	EMDR Protocol and Targets	Sample characteristics	Assessed Outcomes	Is abstinence a requirement for therapy?	Summary points and Key Findings	Effect size Cohens' d
Kullack 2016 Australia	Case series Intervention: EMDR only *3 of the participants were prescribed and taking psychotropic medications	Protocol: Standard EMDR protocol Targets: Trauma memories Number of sessions: Range: 4 – 9 Mean: 6 Length of sessions: 1 hour Bilateral stimulation: Participant 1 and 2 -TheraTappers Participant 3 and 4 – Eye movements	Addiction focus: Alcohol and substance addiction Addiction duration: Participant 1 – Unclear, previously engaged in infrequent social use of marijuana, however, this increased to smoking a 'joint' alone 3-4 times a week following his traumatic incident approx. 4 months ago. Participant 2 – Consuming large quantities of alcohol for approx. 15	Outcome measure of interest: MINI* and participant statements Other: PCL-C*, DES Follow-up: 2 weeks, 6 months and 12 months Posttreatment.	No – participants were known to have active ongoing drug and/ or alcohol abuse prior to and during the intervention.	MINI scores (qualitatively reported as meeting DSM criteria or not) and participant statements were utilised to detect improvement in alcohol and substance use. Three participants reported a reduction in craving, and one participant reported a complete cessation of cravings since completing EMDR treatment. One participant reported complete abstinence and	N/A

First author/ Date/ Place	Methodology	EMDR Protocol and Targets	Sample characteristics	Assessed Outcomes	Is abstinence a requirement for therapy?	Summary points and Key Findings	Effect size Cohens' d
			<p>months (estimate gained from narrative), however, quantity reduced to half a bottle of wine a night in the last three months.</p> <p>Participant 3 – Unclear when addiction started, at time of assessment the participant was drinking alcohol 5 days a week, consuming on average 1 bottle of wine, 4 bottles of beer, and two shots of bourbon each evening.</p> <p>Participant 4 – Unclear, reported as starting binge</p>			<p>three participants reported an overall reduction in their consumption of alcohol or substance use, and for two participants their consumption was limited to social situations only, with no episodes of intoxication or binge use.</p> <p><i>Follow-up</i> All therapeutic gains were maintained at each follow up. The 12 month post-EMDR assessment indicated one participant met</p>	

First author/ Date/ Place	Methodology	EMDR Protocol and Targets	Sample characteristics	Assessed Outcomes	Is abstinence a requirement for therapy?	Summary points and Key Findings	Effect size Cohens' d
			drinking “earlier in the year”, with no reference to the duration of dependency or quantity of alcohol consumption. Total participants: 4 Gender/ age: Participant 1 – Male/ 28 years Participant 2 – Female/ 37 years Participant 3 – Male/ 47 years Participant 4 – Male/ 53 years Comorbidity: PTSD			the diagnostic criteria for current alcohol dependence, and the other three participants no longer met the diagnostic criteria for their respective dependencies.	

Note. All reported effect sizes have been converted to d to facilitate comparisons. According to generally accepted conventions, the effect sizes of $d = .20$, $d = .50$ and $d = .80$ were considered as indices of small, medium, and large group differences (Cohen, 1988). For studies who performed statistical analysis the following significance indicators are used: * $p < .05$; ** $p < .01$; *** $p < .001$. *Key: GEF = Gambling Events

Frequency, SOGS = South Oaks Gambling Screen, DSM-IV = Diagnostic and Statistical Manual of Mental Disorders – Fourth edition, N/A = Not Applicable, SUDs = Subject Units of Distress, VoCs = Validity of Cognitions, OCDS = Obsessive-Compulsive Drinking Scale, ICD-10 = International Classification of Diseases – 10 revision, MALT = Munchner-Alkoholismus Test, Mini-DIPS = Short version of Diagnostic Inventory of Mental Disorders (DIPS), PTSS-10 = Posttraumatic Stress Scale 10-items, DES = Dissociative Experiences Scale, SDQ-5 = Somatic Dissociation Questionnaire-5, BDI = Beck Depression Inventory, STAI = State-Trait-Anxiety Inventory, LOU = Level of Urge, PFS = Positive Feeling Scale, SCLs = Skin Conductance Levels, IAD = Internet Addiction Disorder test, IES-R = Impact of Events Scale – Revised, GHQ = General Health Questionnaire, CERQ = Cognitive Emotion Regulation Questionnaire, PCL-S = PTSD Checklist Specific, ASL = Addiction Severity Index-Lite, SEI = Self-esteem Inventory, TAS-20 = Toronto Alexithymia Scale – 20, G-SAS = Gambling Symptom Assessment Scale, BIS-11 = Barratt Impulsiveness Scale – 11, G-FCQ-S = General State Food Cravings Questionnaire, VAS = Visual Analogue Scale, FTND = Fragerstrom Test or Nicotine Dependence, QSU-brief = Questionnaire of Smoking Urges-brief, SCE = Smoker Craving Experience Questionnaire, RCQ-D = Readiness to Change Questionnaire – Dutch, PANAS = Positive and Negative Affect Scale, PCL-C = PTSD checklist – civilian version, MINI = Mini International Neuropsychiatric Interview.

Table 3

Quality appraisal

First author/ Date/ Place	#1 Treatment Target	#2 Reliable and Valid Measures	3# Assessment	4# Assessor Reliability	5# Manualised Treatment	#6 Random Assignment	#7 Treatment Fidelity	#8 Confounding Conditions	#9 Multimodal Measures	#10 Length of Treatment	#11 Therapist Training Reported	#12 Control Group	#13 Effect Size	Maximal Score Possible	% Representing Each Studies Total
Henry 1996 USA	0.5	0	0	0	1.0	0	0	0	0	0	0 ⁴	0.5	0	13	15%
Cox 2007 USA	1.0	0.5 ⁵	N/A	N/A	1.0	N/A	0.5	N/A	0	0.5 ⁶	0	N/A	N/A	7	50%
Hase 2008 Germany	1.0	1.0	0	0	1.0 ⁷	1.0	0.5	0	0.5 ⁸	0	0	0	0	13	38%

⁴ Some reference to the therapist progressing through different 'levels of training' but lacked specificity, therefore, rated 0.

⁵ Studies that use SUDs, VoCs, LOU, or PFS are given a 0.5 rating as measures offer face validity, however, are deemed inadequate to measure change.

⁶ 15 sessions at the time of writing, however, EMDR was introduced at session 6 and it is unclear how many more EMDR sessions will be offered, therefore, rated 0.5.

⁷ Criterion changed so that both the standard EMDR protocol and addiction-specific protocols could achieve the highest rating if they were documented in a specific and replicable manner.

⁸ 0.5 rating given to studies which included an interview measure into their assessment procedure and/ or behavioural/ physiological measures.

First author/ Date/ Place	#1 Treatment Target	#2 Reliable and Valid Measures	3# Assessment	4# Assessor Reliability	5# Manualised Treatment	#6 Random Assignment	#7 Treatment Fidelity	#8 Confounding Conditions	#9 Multimodal Measures	#10 Length of Treatment	#11 Therapist Training Reported	#12 Control Group	#13 Effect Size	Maximal Score Possible	% Representing Each Studies Total
Abel 2010 USA	1.0	0.5	N/A	N/A	1.0	N/A	0.5	N/A	0	1.0	0	N/A	N/A	7	57%
Miller 2010 USA	1.0	0.5	N/A	N/A	1.0	N/A	0.5	N/A	0	0	0	N/A	N/A	7	42%
Miller 2012 USA	1.0	0.5	0	0	1.0	N/A	0.5	N/A	0.5	1.0	0	N/A ⁹	N/A	9	50%
Bae 2012 South Korea	1.0	1.0	0	0	1.0	N/A	0.5	N/A	0.5	0	0	N/A	N/A	9	44%

⁹ A useful addition to the PS would be a criterion acknowledging the ‘within-subject controls’ in multiple baseline designs.

First author/ Date/ Place	#1 Treatment Target	#2 Reliable and Valid Measures	3# Assessment	4# Assessor Reliability	5# Manualised Treatment	#6 Random Assignment	#7 Treatment Fidelity	#8 Confounding Conditions	#9 Multimodal Measures	#10 Length of Treatment	#11 Therapist Training Reported	#12 Control Group	#13 Effect Size	Maximal Score Possible	% Representing Each Studies Total
Rougemon t-Bucking 2012 Switzerland	1.0	1.0	N/A	N/A	1.0	N/A	1.0	N/A	0	1.0	0.5 ¹⁰	N/A	N/A	7	78%
Meysami-Bonab 2012 Iran	0	1.0 ¹¹	0	0	0	1.0	0.5	1.0	0.5	0.5	0	1.0	0	13	42%

¹⁰ Rating given to acknowledge reference to the therapist being a certified EMDR practitioner, however, levels of training were not provided which prevented a 1.0 rating.

¹¹ Rating given despite an absence of addiction specific measures, because the authors have used reliable and valid measures which are adequate to measure change in their variable of interest (*emotional regulation and recognition*).

First author/ Date/ Place	#1 Treatment Target	#2 Reliable and Valid Measures	3# Assessment	4# Assessor Reliability	5# Manualised Treatment	#6 Random Assignment	#7 Treatment Fidelity	#8 Confounding Conditions	#9 Multimodal Measures	#10 Length of Treatment	#11 Therapist Training Reported	#12 Control Group	#13 Effect Size	Maximal Score Possible	% Representing Each Studies Total
Perez-Danfieu 2014 France	1.0	1.0	0	0	1.0	1.0	0.5	0.5	0.5	0.5	0 ¹²	0.5	0 ¹³	13	50%
Bae 2015 South Korea	1.0	1.0	N/A	N/A	1.0	N/A	0.5	N/A	0	0	0	N/A	N/A	7	50%
Littel 2016 Netherlands	1.0	1.0	0	0	1.0	0	N/A ¹⁴	1.0	0.5	0	0	1.0	1.0	12	54%

¹² Author stated EMDR was facilitated by a ‘qualified clinician’ with no further information provided, therefore, 0 rating given.

¹³ Study scored 0, as the authors calculated and presented the effect sizes for baseline data only.

¹⁴ Deemed N/A as the study utilised a lab based EMDR model and, therefore, we are unable to assess treatment fidelity.

First author/ Date/ Place	#1 Treatment Target	#2 Reliable and Valid Measures	3# Assessment	4# Assessor Reliability	5# Manualised Treatment	#6 Random Assignment	#7 Treatment Fidelity	#8 Confounding Conditions	#9 Multimodal Measures	#10 Length of Treatment	#11 Therapist Training Reported	#12 Control Group	#13 Effect Size	Maximal Score Possible	% Representing Each Studies Total
Markus 2016 Germany	1.0	0.5 ¹⁵	0	0	1.0	1.0	N/A	1.0	0.5	0	0	1.0	1.0	12	58%
Kullack 2016 Australia	1.0	0.5	0	0	1.0	N/A	0.5	N/A	0.5	0 ¹⁶	0.5	N/A	N/A	9	44%

Note. Possible PS total score for each study is provided, and actual total scores achieved have been converted into % to represent each studies overall quality rating. N/A was utilised when the criterion was not applicable to the study design. If studies have utilised self-report measures only, item #3 and item #4 is rated as N/A due to not requiring an assessor. If a diagnostic interview has been utilised then an assessor and the corresponding training is considered required and rated accordingly, unless otherwise specified by the paper. Item #10 we adopted the same theoretical rationale proposed by Hertlien and Ricci (2004) who devised the PS and Carlson, Chemtob, Rusnak, Hedlund, and Muraoka (1998) whereby 10 sessions is in keeping with the accepted protocol for traditional brief psychotherapy. Although extant literature demonstrates EMDR effectiveness in less than 10 sessions (e.g., Vaughan et al., 1994), given the complexity of the addiction population and possible trauma

¹⁵ Two of the addiction measures utilised were either not validated or had 'questionable' psychometric properties, however, the other measures were satisfactory meaning a rating of 0.5 was allocated.

¹⁶ Although the range of sessions was 4-9, the rating was based on the mean session number of 6, therefore, 0 rating given.

comorbidity we felt that this number of treatment sessions would allow sufficient time to trial the use of EMDR with addicted participants and, therefore, studies were scored according to this criteria.

Discussion

This review considers whether research focusing on the use of EMDR treatment in addiction has demonstrated its effectiveness with this population. Fourteen papers were reviewed and rated according to the PS quality framework. The findings will be discussed in regard to the overarching questions posed by this review.

Is EMDR an effective treatment for reducing the frequency of addiction?

The studies under review constitute a positive beginning to the research on using EMDR with chemically and behaviourally addicted individuals. Given the improvement seen across studies with the exception of two, we could hypothesise that both chemical and behavioural addictions do share the same altered neurocircuitry of the reward/pleasure pathways creating habit formation (Holden 2001), as both respond favourably to EMDR. However, whether emotive and addiction-related memories differ in malleability remains unclear, partly due to the variable length and irregularity of treatment between studies.

Moreover, five studies reported a reduction both in the addiction and PTSD/trauma symptomatology, suggesting the self-medication hypothesis may hold significance here. This finding is consistent with a large body of literature which recognises the role unresolved trauma plays in maintaining the addiction cycle (Peirce et al., 2008), and the subsequent use of addictive processes to self-regulate and medicate disturbing feelings (Zweben & Yeary, 2006), making it difficult to achieve extended periods of abstinence while the trauma remains unprocessed. Whether there are qualitative or quantitative differences in sobriety attainment based on trauma (i.e. PTSD or small t) is unknown due to the limited studies available.

Furthermore, poorly managed affect can be a principal trigger for relapse (O'Brien & Abel, 2011), therefore, Meysami-Bonab et al. (2012) finding that EMDR significantly improves participants emotional regulation and recognition abilities suggests EMDR could play an important role in relapse prevention. Eight studies conducted follow ups ranging from one week to 2 years. Six of the eight studies demonstrated positive treatment outcomes namely sobriety or controlled use which were durable over time.

However, as noted earlier the methodological issues and heterogeneity between studies mean these results must be interpreted with caution. For example, the limited use of addiction specific validated instruments, small sample sizes which make the likelihood of sample specific findings greater and inconsistent participant exposure to EMDR, precludes any conclusions and makes apparent the need for methodologically sound comparison studies.

Is it necessary for therapists to employ addiction-orientated protocols to achieve positive outcomes?

The standard EMDR protocol, DeTUR, CravEx, and FSAP have all demonstrated positive outcomes. The decision on which protocol to use and when, is arguably complex, consideration would need to be given to the presence of trauma and whether this plays a causal role in the addiction or if it is only peripherally related. If the trauma preceded the addiction, the trauma may need to be resolved for the patient to sustain an *abstemious* way of life. Henry (1996) stated the standard protocol helped reduce the frequency of gambling only in patients with a history of trauma; however, this observation was based on one non-traumatised participant in the EMDR group not benefiting from treatment.

Hase et al. (2008) proposes the cue-reactivity and power of the AM is comparable to the maladaptive traumatic memory formation witnessed in PTSD and elucidated by the AIP model. Similarly, Miller (2010) argues the feeling-state which is considered an intensely positive event, creates a similar state-dependant memory to that of trauma which becomes stuck and stored in isolation away from the adaptive memory networks. If the AM, feeling-state, or urges and triggers for addiction are indeed separate to the processing of traumatic material, this may call for an integrated approach of protocols as witnessed in the Abel and O'Brien (2010) study. Conversely, this raises questions of Kullack and Laugharne (2016) study who witnessed reduced alcohol dependence among trauma participants after only employing the standard EMDR protocol, whereas, Perez-Dandieu and Tapia (2014) attributed part of their failing to elicit change in addiction to their sole use of the standard protocol.

Moreover, Rougemont-Bucking et al. (2012) facilitated an extended resource installation phase (>10 months) with one participant who had experienced drug addiction for approximately 38 years and complex PTSD, this suggests the longevity of addiction and complexity of any co-occurring trauma may also influence protocol choice and use. This is consistent with research that suggests poor self-efficacy and high volumes of negative affect coupled with poor coping skills are relapse risk factors (Marich, 2010) and, therefore, greater investment in the resource development and installation phase may be required to ensure therapeutic gains achieved are sustainable. The narratives of the authors suggest that EMDR in the treatment of addiction demands a wider variety of targets and more flexibility in the protocol application compared with the treatment of PTSD alone. Subsequently, clear statements regarding favourable protocols or targets cannot currently be made and deserve much further study before this review question can be answered with confidence.

Can patients benefit from EMDR if they are still engaged in their respective addiction?

The results would suggest that the application of EMDR targeted at addiction or trauma is feasible and safe in this patient population, even when patients are still engaging in their respective addiction. Inhibitory control over drug consumption and other behavioural strategies (i.e. avoidance) is regulated by the same cerebral regions of the prefrontal cortex (Peters, Kalivas, & Quirk, 2009). For this reason it is argued by some that psychotherapy should be available to all patients whom share the deficit in inhibitory circularity regardless if this manifests as a chemical or behavioural addiction/ coping response (Rougemont-Bucking et al., 2012). Moreover, Perez-Dandieu and Tapia (2014) demonstrated that a reduction in PTSD symptomatology can occur beyond abstinence. Contrawise, Hase et al. (2008) was the only study conducted in a real-world treatment setting which required complete abstinence of participants, interestingly, this study was plagued by a high attrition rate. Arguably, if participants are engaged in the addictive behaviour during treatment, the effect of treatment is easier to perceive.

The FSAP protocol incorporates homework which requires participants to engage in the addictive act whilst noting any changes to behaviour and feeling as a way to evaluate the progress of therapy (Miller, 2010). Because the DeTUR and FSAP

explicitly state that patients are not required to control their behaviour, patient retention may be greater.

Moreover, although stable abstinence is preferable the FSAP states that “abstinence is neither necessary nor desired” (Miller, 2010, p. 5) upon treatment completion, which is a sentiment echoed by the DeTUR protocol stating “although abstinence is preferred, better control of urge is the goal” (Bae, Han, & Kim, 2015, p. 333). This is in line with a harm reduction approach which is becoming increasingly popular within the addiction field, suggesting both abstinence and reduction in the addictive behaviour can be regarded as a successful treatment outcome (Martlatt & Gordon, 1998). In addition, relapsing during treatment is promoted by some authors as a normal and a somewhat expected event in the treatment process and should not be taken as a treatment failure or a reason to discontinue. As it appears, a relapse in therapy has little to no effect on treatment outcome (Abel & O’Brien, 2010; Rougemont-Bucking et al., 2012). However, limited data prohibits firm conclusions and further research on the effects of sobriety attainment or lack thereof, before and during EMDR therapy on outcome is warranted.

Limitations

The overall number of studies included within this review was limited; however, this was based on the current availability of research within this area. Non-English papers were discounted, this may have introduced language and publication bias favouring positive results, although the extent of this bias amongst the literature is diminishing (Balk, Chung, Chen, Trikalinos, & Chang, 2012). Grey literature was excluded with the intention of theoretically improving the methodological quality of the research, however, future reviews may wish to include this to broaden the literature available to them and avoid erroneous conclusions. Finally, although objective quality criteria was utilised to appraise the studies, it is likely that the authors own subjective bias influenced the ratings given to each study.

Future Research

Given the existing political climate allocates undue preference to evidence-based treatments, the next step of EMDR and addiction research is the employment of random assignment clinical trials. Further study would elucidate the conditions that would maximise a patient's chance of success, be it abstinence or harm reduction.

Consideration of the following questions would also be encouraged:

- Do certain protocols work more effectively with particular patients? Particular addictions?
- How does the implementation of EMDR protocols augment addiction treatment?
- Does the patient have to be abstinent to benefit from EMDR treatment? If no, under what conditions would it be advisable for a therapist to proceed?
- How can EMDR treatment most effectively target specific relapse triggers?

Markus, Weert-van Oene, Becker, and DeJong (2015) have published a study protocol for a multi-site randomised trial comparing EMDR added to TAU versus TAU for alcohol dependency, with a target recruitment of 100 participants. This will be a welcome addition to the EMDR research community, however, to accurately discern the effect of EMDR a readiness to suspend any concomitant psychological treatment and sustain baseline levels of psychotropic medication over the duration of the study would be recommended. Also, to exclude the principle investigator from treatment and data-collection is vital to minimise outcome bias, in addition to the use of an addiction specific validated instrument to capture measureable changes to addiction. Moreover, we advise future researchers to consider the PS scale criteria when designing their EMDR studies, which would help to clarify much of the controversy surrounding outcomes of EMDR research.

Word count: 5, 992

References

- Abel, N. J., & O'Brien, J. M. (2010). EMDR Treatment of Comorbid PTSD and Alcohol Dependence: A Case Example. *Journal of EMDR Practice and Research*, 4(2), 50-59. doi:10.1891/1933-3196.4.2.50
- Bae, H., & Kim, D. (2012). Desensitization of Triggers and Urge Reprocessing for an Adolescent with Internet Addiction Disorder. *Journal of EMDR Practice and Research*, 6(2), 73-81. doi:10.1891/1933-3196.6.2.73
- Bae, H., Han, C., & Kim, D. (2015). Desensitization of Triggers and Urge Reprocessing for Pathological Gambling: A Case Series. *Journal of Gambling Studies*, 31, 331-342. doi:10.1007/s10899-013-9422-5
- Balk, M. E., Chung, M., Chen, M. L., Trikalinos, T. A., & Chang, L. K. W. (2012). *Assessing the Accuracy of Google Translate to Allow Data Extraction From Trials Published in Non-English Languages*. Retrieved from <http://www.ncbi.nlm.nih.gov/pubmedhealth/PMH0077683/>
- Barbieri, J. L. (2008). The URGES Approach: Urge Reduction by Growing Ego Strength (URGES) for Trauma/Addiction Treatment Using Alternate Bilateral Stimulation, Hypnotherapy, Ego State Therapy and Energy Psychology. *Sexual Addiction & Compulsivity*, 15(2), 116-138. doi:10.1080/10720160802035584
- Brown, S. (2003). *The missing piece: The case for EMDR-based treatment for posttraumatic stress disorder and co-occurring substance use disorder*. Retrieved from <https://emdria.omeka.net/items/show/18329>

- Brown, S. H., Gilman, S. G., Goodman, E. G., County, T., Court, D., Adler-tapia, R., & Freng, S. (2015). Integrated Trauma Treatment in Drug Court: Combining EMDR Therapy and Seeking Safety. *Journal of EMDR Practice and Research*, 9(3), 123-136. doi:10.1891/1933-3196.9.3.123
- Carlson, J., Chemtob, C., Rusnak, K., Hedlund, N., & Muraoka, M. (1998). Eye movement desensitization and reprocessing (EMDR) treatment for combat-related posttraumatic stress disorder. *Journal of Traumatic Stress*, 11(1), 3-24. doi:10.1023/A:1024448814268
- Cash, A. (2006). *Posttraumatic stress disorder*. Hoboken, NJ: Wiley.
- Clarkin, J. F., & Levy, K. N. (2004). The influence of client variables on psychotherapy. In: M. Lambert (Eds.), *Handbook of psychotherapy and behavioral change* (pp. 194-226). New York, NY: Wiley; 2004.
- Cohen, J. (1988). *Statistical power analysis for the behavioural sciences*. New York, NY: Lawrence Erlbaum Associates.
- Cox R. P., & Howard, M. D. (2007). Utilization of EMDR in the Treatment of Sexual Addiction: A Case Study. *Sexual Addiction & Compulsivity*, 14(1), 1-20. doi:10.1080/10720160601011299
- Critical Appraisal Skills Programme (2011). *Critical Appraisal Skills Programme: Making sense of evidence about clinical effectiveness: 11 questions to help you make sense of a trial*. Retrieved from <http://www.casp-uk.net/#!/casp-tools-checklists/c18f8>

- Emmelkamp, P. & Vedel, E. (2006). *Evidence-Based Treatment for Alcohol and Drug Abuse: A Practitioner's Guide to Theory, Methods, and Practice*. New York, NY: Routledge.
- Floen, S. K., & Elklit, A. (2007). Psychiatric diagnoses, trauma, and suicidality. *Annals of General Psychiatry*, 6, 12. doi:10.1186/1744-859X-6-12
- Flyvbjerg, B. (2006). Five Misunderstandings About Case-Study Research. *Qualitative Inquiry*, 12(2), 219–245. doi:10.1177/1077800405284363
- Foa, E. B., & Meadows, E. A. (1997). Psychosocial treatments for posttraumatic stress disorder: A critical review. *Annual Review of Psychology*, 48, 449-480. doi:10.1146/annurev.psych.48.1.449
- Foa, E. B., Keane, T. M., Friedman, M. J., & Cohen, J. A. (2009). *Effective treatment for PTSD: Practice guidelines from the International Society for Traumatic Stress Studies* (2nd ed.). New York, NY: Guilford Press.
- Franklin, J. K. (2015). *The effectiveness of EMDR therapy on clients with addictions* (Unpublished masters dissertation). Smith College School for Social Work, Massachusetts.
- Gooding, P., & Tarrier, N. (2009). A systematic review and meta-analysis of cognitive-behavioural interventions to reduce problem gambling: Hedging our bets? *Behaviour Research and Therapy*, 47(7), 592-607. doi:10.1016/j.brat.2009.04.002
- Harrington, T., & Newman, E. (2007). The psychometric utility of two self-report measures of PTSD among women substance users. *Addictive Behaviors*, 32(12), 2788-2798. doi:10.1016/j.addbeh.2007.04.016

- Hase, M., Schallmayer, S., & Sack, M. (2008). EMDR reprocessing of the addiction memory: Pretreatment, posttreatment and 1-month follow-up. *Journal of EMDR Practice and Research*, 2(3), 170-179. doi:10.1891/1933-3196.2.3.170
- Hase, M. (2010). CraveEx: An EMDR approach to treat substance abuse and addiction. In M. Luber (Eds.), *EMDR scripted protocols* (pp. 467–488). New York, NY: Norton.
- Henry, S. L. (1996). Pathological gambling: Etiologic considerations and treatment efficacy of eye. *Journal of Gambling Studies*, 12(4), 395-405. doi:10.1007/BF01539184
- Hertlein, K. M., & Ricci, R. J. (2004). A systematic research synthesis of EMDR studies: implementation of the platinum standard. *Trauma, Violence & Abuse*, 5(3), 285-300. doi:10.1177/1524838004264340
- Holden, C. (2001). Behavioral addictions: Do they exist? *Science*, 294, 980-82. doi:10.1126/science.294.5544.980
- Hyman, S. (2005). Addiction: A disease of learning and memory. *American Journal of Psychiatry*, 162(8), 1414-22. doi:10.1176/appi.ajp.162.8.1414
- Isaac, S., & Michael, W. B. (1995). *Handbook in research and evaluation* (3rd ed.). San Diego, CA: Educational and Industrial Testing Services.
- Karim, R., & Chaudhri, P. (2012). Behavioral addictions: An overview. *Journal of Psychoactive Drugs*, 44(1), 5-17. doi:10.1080/02791072.2012.662859

Kazdin, A. E. (1994). Methodology, design, and evaluation in psychotherapy research.

In A. E. Bergin & S. L. Garfield (Eds.), *Handbook of psychotherapy and behavior change* (pp. 19-71). New York, NY: John Wiley.

Kullack, C., & Laugharne, J. (2016). Standard EMDR Protocol for Alcohol and Substance Dependence Comorbid With Posttraumatic Stress Disorder: Four Cases With 12-Month Follow-Up. *Journal of EMDR Practice and Research*, 10(1), 33-46. doi:10.1891/1933-3196.10.1.33

Ledgerwood, D. M., & Petry, N. M. (2006). Posttraumatic stress disorder symptoms in treatment-seeking pathological gamblers. *Journal of Traumatic Stress*, 19(3), 411-416. doi:10.1002/jts.20123

Littel, M., van den Hout, M. A., & Engelhard, I. M. (2016). Desensitizing Addiction: Using Eye Movements to Reduce the Intensity of Substance-Related Mental Imagery and Craving. *Frontiers in Psychiatry*, 7(14). doi:10.3389/fpsy.2016.00014

Logie, R. (2014). ARTICLE EMDR – more than just a therapy for PTSD ? *The Psychologist*, 27(7), 512-517. Retrieved from <https://thepsychologist.bps.org.uk/volume-27/edition-7/emdr-more-just-therapy-ptsd>

Marich, J. (2009). EMDR in the Addiction Continuing Care Process: Case Study of a Cross-Addicted Female's Treatment and Recovery. *Journal of EMDR Practice and Research*, 3(2), 98-106. doi:10.1891/1933-3196.3.2.98

- Marich, J. (2010). Eye movement desensitization and reprocessing in addiction continuing care: A phenomenological study of women in recovery. *Psychology of Addictive Behaviors*, 24(3), 498-507. doi:10.1037/a0018574
- Markus, W., de Weert -van Oene, G. H., Becker, E. S., & DeJong, C. A. J. (2015). A multi-site randomized study to compare the effects of Eye Movement Desensitization and Reprocessing (EMDR) added to TAU versus TAU to reduce craving and drinking behavior in alcohol dependant outpatients: study protocol. *BMC Psychiatry*, 15(51), 1-14. doi:10.1186/s12888-015-0431-z
- Markus, W., de Weert -van Oene, G. H., Woud, M. L., Becker, E. S., & Dejong, C. A. J. (2016). Are addiction-related memories malleable by working memory competition? Transient effects on memory vividness and nicotine craving in a randomized lab experiment. *Journal of Behavior Therapy and Experimental Psychiatry*, 52, 83-91. doi:10.1016/j.jbtep.2016.03.007
- Marlatt, G. A., & Gordon, J. R. (1998). *Harm reduction: Pragmatic strategies for managing high risk behaviors*. New York, NY: Guilford.
- Marlatt, G. A., & Witkiewitz, K. (2002). Harm reduction approaches to alcohol use: health promotion, prevention, and treatment. *Addictive Behaviors*, 27(6), 867-86. Retrieved from <http://www.ncbi.nlm.nih.gov/pubmed/12369473>
- Martin, P. R., & Petry, N. M. (2005). Are non-substance-related addictions really addictions? *The American Journal on Addictions / American Academy of Psychiatrists in Alcoholism and Addictions*, 14, 1-7. doi:10.1080/10550490590899808

- Maxfield, L., & Hyer, L. (2002). The relationship between efficacy and methodology in studies investigating EMDR treatment of PTSD. *Journal of Clinical Psychology*, 58(1), 23-41. doi:10.1002/jclp.1127
- McLellan, A. T., Lewis, D. C., Brien, C. P. O., & Kleber, H. D. (2014). Drug Dependence, a Chronic Medical Illness: implications for treatment, insurance, and outcomes evaluation. *JAMA*, 284(13), 1689-1695. doi:10.1001/jama.284.13.1689
- Meysami-Bonab, S., Abolghasemi, A., Sheikhan, M., Barahmand, U., & Rasooliazad, M. (2012). The Effectiveness of Eye Movement Desensitization and Reprocessing Therapy on the Emotion Regulation and Emotion Recognition of Addicted Individuals. *Zahedan Journal of Research in Medical Sciences*, 14(10), 33-37. Retrieved from <http://www.zjrms.ir/article-1-2161-en.html>
- Miller, D., & Guidry, L. (2001). *Addictions and trauma recovery: Healing the body, mind, and spirit*. New York, NY: W. W. Norton.
- Miller, R. (2010). The feeling-state theory of impulse-control disorders and the Impulse-Control Disorder Protocol. *Traumatology*, 16(3), 2-10. doi:10.1177/1534765610365912
- Miller, R. (2012). Treatment of Behavioral Addictions Utilizing the Feeling-State Addiction Protocol: A Multiple Baseline Study. *Journal of EMDR Practice and Research*, 6(4), 159-169. doi:10.1891/1933-3196.6.4.159
- Najavits, L. M., & Hien, D. (2013). Helping vulnerable populations: A comprehensive review of the treatment outcome literature on substance use disorder and PTSD. *Journal of Clinical Psychology*, 69(5), 433-479. doi:10.1002/jclp.21980

- O'Brien, J. M., & Abel, N. J. (2011). EMDR, Addictions, and the Stages of Change: A Road Map for Intervention. *Journal of EMDR Practice and Research*, 5(3), 121-130. doi:10.1891/1933-3196.5.3.121
- Oren, E., & Solomon, R. (2012). Original article EMDR therapy : An overview of its development and mechanisms of action La thérapie EMDR : un aperç u de ses développements et mécanismes d ' action. *Revue Européenne de Psychologie Appliquée*, 62(4), 197-203. doi:10.1016/j.erap.2012.08.005
- Peirce, J. M., Kindbom, K. A., Waesche, M. C., Yuscavage, A. S., & Brooner, R. K. (2008). Posttraumatic stress disorder, gender, and problem profiles in substance dependant patients. *Substance Use & Misuse*, 43(5), 596-611. doi:10.1080/10826080701204623
- Perez-Dandieu, B., & Tapia, G. (2014). Treating Trauma in Addiction with EMDR: A Pilot Study. *Journal of Psychoactive Drugs*, 46(4), 303-9. doi:10.1080/02791072.2014.921744
- Peters, J., Kalivas, P. W., & Quirk, G. J. (2009). Extinction circuits for fear and addiction overlap in prefrontal cortex. *Learning Memory*, 16(5), 279-88. doi:10.1101/lm.1041309
- Popky, A. J. (2005). DeTUR, an urge reduction protocol for addictions and dysfunctional behaviors. In R. Shapiro (Eds.), *EMDR solutions: Pathways to healing* (pp. 167-188). New York, NY: Norton
- Potenza, M. N. (2006). Should addictive disorders include non-substance-related conditions? *Addiction*, 101(1), 142-51. doi:10.1111/j.1360-0443.2006.01591.x

- Rougemont-Bucking, A., & Zimmermann, E. N. (2012). EMDR-based treatment of psychotraumatic antecedents in illicit drug abusers: A report of two cases. *Schweizer Archiv Fur Neurologie Und Psychiatrie*, 163(3), 107-15. Retrieved from https://www.researchgate.net/publication/230680389_EMDR-based_treatment_of_psychotraumatic_antecedents_in_illicit_drug_abusers
- Rizeanu, S. (2012). The specificity of pathological gambling. *Procedia-Social and Behavioural Science*, 33, 1082-1086. doi:10.1016/j.sbspro.2012.01.289
- Schneider, J. P. (2004). Sexual Addiction & Compulsivity: Twenty Years of the Field, Ten Years of the Journal. *Sexual Addiction & Compulsivity*, 11(1-2), 3-5. doi:10.1080/10720160490458193
- Shapiro, F., Vogelmann-Sine, S., & Sine, L. (1994). Eye movement desensitization and reprocessing: Treating trauma and substance abuse. *Journal of Psychoactive Drugs*, 26(4), 379-391. doi:10.1080/02791072.1994.10472458
- Shapiro, F. (1999). Eye movement desensitization and reprocessing (EMDR) and the anxiety disorders: Clinical and research implications of an integrated psychotherapy treatment. *Journal of Anxiety Disorders*, 13(1-2), 35-67. doi:10.1016/S0887-6185(98)00038-3
- Shapiro, F. (2001). *Eye movement desensitization and reprocessing: Basic principles, protocols, and procedures* (2nd ed.). New York, NY: Guildford Press.
- Shapiro, F. (2014). The Role of Eye Movement Desensitization and Reprocessing (EMDR) Therapy in Medicine : Addressing the Psychological and Physical Symptoms Stemming from Adverse Life Experiences. *The Permanente Journal*, 18(1), 71-77. doi:10.7812/TPP/13-098

- Tamam, L., Zengin, M., Karakus, G., & Ozturk, Z. (2008) Impulse control disorders in an inpatient psychiatry unit of a university hospital. *Klinik Psikofarmakoloji Bulteni-Bulletin Of Clinical Psychopharmacology*, 18(3), 153-161. Retrieved from <http://www.scopemed.org/?mno=2997>
- Tesarz, J., Leisner, S., Gerhardt, A., Janke, S., Seidler, G. H., Eich, W., & Hartmann, M. (2014). Effects of Eye Movement Desensitization and Reprocessing (EMDR) Treatment in Chronic Pain Patients: A Systematic Review. *Pain Medicine*, 15(2), 247-263. doi:10.1111/pme.12303
- van Dam, D., Ehring, T., Vedel, E., & Emmelkamp, P. M. (2010). Validation of the Primary Care Posttraumatic Stress Disorder screening questionnaire (PC-PTSD) in civilian substance use disorder patients. *Journal of Substance Abuse Treatment*, 39(2), 105-113. doi:10.1016/j.jsat.2010.05.005
- Vaughan, K., Armstrong, M., Gold, R., O'Connor, N., Jenneke, W., & Tarrier, N. (1994). A trial of eye movement desensitization compared to image habituation training and applied muscle relaxation in post-traumatic stress disorder. *Journal of Behavior Therapy and Experimental Psychiatry*, 25(4), 283-291. doi:10.1016/0005-7916(94)90036-1
- Volkow, N. D., & Fowler, J. S. (2000). Addiction, a disease of compulsion and drive: involvement of the orbitofrontal cortex. *Cerebral Cortex*, 10(3), 318-25. doi:10.1093/cercor/10.3.318
- Young, K. S. (2007). Cognitive behavior therapy with internet addicts: Treatment outcomes and implications. *Cyberpsychology & Behavior*, 10(5), 671-679. doi:10.1089/cpb.2007.9971

Zweben, J., & Yeary, J. (2008). EMDR in the Treatment of Addiction. *Journal of Chemical Dependency Treatment*, 8(2), 115-127. doi:10.1300/J034v08n02

Journal Paper

Brain Work Recursive Therapy for Non-Complex Trauma: A Case Series Design

BWRT for Non-Complex Trauma

Hayley L. Rose¹ | Dave L. Dawson¹ | Thomas Schröder² | Anne Abey³

¹University of Lincoln, Life and Social Sciences, 1st Floor, Bridge House, Brayford
Pool, Lincoln LN5 7AY, UK*

²University of Nottingham, Division of Psychiatry and Applied Psychology, School of
Medicine; B12, YANG Fujia Building, Jubilee Campus, Wollaton Road, Nottingham
NG8 1BB, UK

³Lincolnshire Partnership NHS Foundation Trust, Physical Health Psychology, 14a
Grantham Hospital, 101 Manthorpe Road, Grantham NG31 8DG, UK

*Corresponding author: David L Dawson, E-mail address: ddawson@lincoln.ac.uk

Conflict of Interest

There is no conflict of interest to declare by the authors.

Acknowledgments

Special thanks given to Bridget Goard and Lynsey Wood, both of whom worked within the specialist service from which participants were recruited and provided the BWRT intervention.

Sponsorship and funding provided through the University of Lincoln.

Abstract

Brain Work Recursive Therapy (BWRT) is a new addition to the psychotherapy arena. Not yet subject to controlled research, the positive claims regarding the effectiveness of BWRT are limited to anecdotal evidence. This study sought to investigate these claims, including the possible treatment mechanisms underpinning this approach using a non-complex trauma sample (n=6). A mixed method single case experimental design incorporating physiological and psychological measurement was utilised. Overall, participants demonstrated reductions in traumatic stress and associated measures, including an attenuation of emotionality and vividness of the target trauma memory. A concomitant increase was found on heartrate variability indices offering further support for the resolution of post-trauma difficulties, which was substantiated by participant's qualitative reports. Possible treatment mechanisms are considered with reference to habituation and dual taxation processes. Preliminary findings are positive; however, further research is essential to determine the efficacy of BWRT and better our understanding of how it works.

Key Practitioner Message

- Adverse life events that do not meet PTSD diagnostic criterion, can produce effects comparable to major trauma and, therefore, should not be overlooked as a source of trauma in clinical practice.
- BWRT may be a better tolerated therapy when compared to traditional exposure therapies and subsequently may lead to greater retention and maintenance of treatment gains. However, this has yet to be tested and the follow-up period in this study is not sufficient to claim that effects outlast those of other therapies.
- The potential for BWRT to offer alleviation of trauma symptomology in a single session is a welcomed prospect given the current climate of the NHS and the economic pressures within healthcare-systems.

Keywords: Brain Work Recursive Therapy, BWRT, trauma, working memory, habituation, heartrate variability

Introduction

Trauma is a common phenomenon with most people experiencing at least one, if not, several potential traumas during their lifetime (Copeland, Keeler, Angold, & Costello, 2007). Symptoms following traumatic exposure can include both psychological and physiological alterations (Frustaci, Lanza, Fernandez, di Giannantonio, & Pozzi, 2010) that may be short-lived or long lasting. The Diagnostic and Statistical Manual of Mental Disorders, Third Edition (DSM-III; American Psychiatric Association, 1980; APA) attempted to conceptualise trauma responses with the introduction of Post-traumatic Stress Disorder (PTSD). Whilst the PTSD diagnostic category has offered knowledge about the impact of trauma and has stimulated greater research in traumatic stress (Bonanno & Mancini, 2012), it has also been accompanied by definitional controversies¹⁷.

Taxometric analyses have reliably shown the dimensional rather than categorical structure of PTSD (Broman-Fulks et al., 2006; Ruscio, Ruscio, & Keane, 2002), meaning PTSD is best understood as a continuous dimension extending from mild to severe trauma presentations rather than a discrete clinical category. To acknowledge this, individuals presenting with traumatic stress symptoms that fail to meet PTSD criterion are often referred to as experiencing ‘subthreshold or partial’ PTSD, the existence of which is considered just as prevalent as ‘full PTSD’ in community populations (Stein, Walker, Hazen, & Forde, 1997; Zlotnick, Franklin, & Zimmerman, 2002). In the United States, prevalence rates for PTSD have varied considerably between 12.8% and 46% (Franklin, Sheeran, & Zimmerman, 2002; Villano et al., 2007) and epidemiological studies have identified wide ranging co-morbidity rates for traumatic stress from 21% to 94% for depression and 39% to 97% for anxiety (Ginzburg, Ein-Dor, & Solomon, 2010; Pietrzak, Goldstein, Southwick, & Grant, 2011).

There is much debate regarding what events should qualify as antecedents to PTSD (Van Hooff, McFarlane, Baur, Abraham, & Barnes, 2009), with existing guidelines specifying this as the presence of threat to life or physical integrity (DSM-5; APA, 2013). However, increasingly research has demonstrated that adverse life events

¹⁷ See extended paper sections 1.1 and 1.2 for further discussion on the gradients of trauma and epidemiology respectively.

(e.g., relationship problems or unemployment) which do not meet the abovementioned classification, can produce effects comparable to major trauma causing significant psychosocial impairment (Gold, Marx, Soler-Baillo, & Sloan, 2005; Van Hooff et al., 2009) and financial cost, both on personal and societal levels (Foa & Jaycox, 1999).

There are many competing theories attempting to provide a satisfactory account of the multifaceted phenomena and processes involved in PTSD (Schubert & Lee, 2009). While there are individual variations in trauma response, most trauma theories recognise the role of avoidance in maintaining symptomology and, therefore, many trauma focused interventions are designed to counter this through memory activation, exposure and habituation processes (Brewin & Holmes, 2003; Ehlers & Clark, 2000; Foa & Kozak, 1986).

Exposure to highly distressing stimuli in therapy can be both real or imaginal, and short-term or prolonged (Taylor, 2002). The therapeutic effects of exposure are thought to occur when avoidance to the aversive stimuli is prevented (Tryon, 2005) and habituation is achieved (Thompson & Spencer, 1996). Habituation is operationalised as a “response decrement as a result of repeated stimulation” (Harris, 1943, p.385) first accompanied by the activation of cardiovascular parameters (e.g., increased heart rate; HR), followed by a lowered arousal upon repeated presentation of the feared stimuli (Jaycox, Foa, & Morral, 1998). Estimates regarding how long habituation should take vary considerably, ranging from 100 minutes or more for trauma scenes (Keane, 1995), 50-60 minutes for agoraphobia, and 20 minutes of imaginal exposure for phobias (Foa, Steketee, & Rothbaum, 1989). However, there appears a consensus that for duration of effects habituation works most effectively when it is both prolonged and repeated (Chaplin & Levine, 1981; Foa & Kozak, 1986; Rodgers & Silver, 2002), and is without distraction or avoidance (Brewin & Holmes, 2003; Mowrer, 1960). Yet interestingly, a dose-response relationship is acknowledged with suggestions of very transient exposure times (10-15s) being effective with low-intensity stimuli and arousal levels (Craske, 1999).

Theories underpinned by exposure and habituation processes include the Conditioning Model (Mowrer, 1956), the Cognitive Model (Ehlers & Clark, 2000) and the Emotional Processing Model (EPM; Foa & Kozak, 1986). Conditioning theory

centres on learned associations and reinforcement, whereby the reprieve from fear takes place upon removal of the threat, which encourages the negative reinforcement of avoidance behaviour (González-Prendes & Resko, 2012). Consequently, exposure and habituation are considered essential to the uncoupling of such stimulus–response associations. Conversely, cognitive theory recognises faulty appraisals of the trauma, trauma sequelae, and the trauma memory itself as a key determinant of persistent traumatic stress (Ehlers & Clark, 2000). Cognitive modification requires the initial activation of the fear memory which arguably entails exposure and habituation processes, however, this is not the focus for therapeutic change. The EPM offers an amalgamation of learning and cognitive theories, postulating successful resolution of problematic anxiety to initially start with the activation of the fear memory through unavoided exposure. Ensuing short-term physiological habituation is then considered to challenge an individual’s erroneous beliefs about anxiety and attitudes towards coping, prompting a cognitive change that is incompatible with the original fear memory and which discourages further avoidance (Brewin & Holmes, 2003). Despite the hypothesised differences, each theory appears to share exposure and habituation change mechanisms, albeit to differing extents.

Further to this is the Polyvagal theory¹⁸ (Porges, 1995) which provides a neurophysiological understanding of trauma responses, conceptualising physiological parameters as if they were observable behaviors. Porges (2007) elucidates the phylogenetic origins of brain structures responsible for regulating physiological arousal when faced with danger, with the ‘Social Engagement System’ being considered the most sophisticated neural circuit. This system allows us to unconsciously assess our surroundings as safe or threatening, through a process termed ‘neuroception’ (Porges, 2011). Research suggests impaired neuroception capabilities are inherent in traumatised individuals, often leading to an overestimation of danger when the environment is in fact safe (Chang et al., 2013; Porges, 2007).

When regulation systems are functioning effectively, a ventral vagal ‘brake’ is utilised to inhibit our threat response and use of the sympathetic nervous system

¹⁸ See extended paper section 1.4.4 for further discussion regarding the Polyvagal Theory and heartrate variability.

(Porges, 2011). This nerve creates a pattern of HR fluctuations, known as heart rate variability (HRV; Appelhans & Luecken, 2006), measurement of which can reveal important information about the activity of the ventral vagus and social engagement system (Porges, 2007), and may have value in predicting therapeutic response to treatment (Beauchaine, Gatzke-Kopp, & Mead, 2007; Kemp, Quintana, Felmingham, Matthews, & Jelinek, 2012; Nishith et al., 2003).

High HRV reflects adaptive use of the vagal ‘brake’ and is associated with self-soothing capabilities in the presence of threat (Rockcliff, Gilbert, McEwan, Lightman, & Glover, 2008). For trauma-exposed individuals, lower vagal regulation has been found (Chang et al., 2013; Guédon-Moreau et al., 2012) alongside decreased parasympathetic activity (Lee & Theus, 2012; Tan, Dao, Farmer, Sutherland, & Gevirtz, 2011), and rigid response regulation (Friedman & Thayer, 1999).

Existing trauma therapies recommended by the National Institute of Clinical Excellence (NICE, 2005) for children, adolescents and adults are limited to Trauma-Focused Cognitive Behavioural Therapy (TF-CBT) and Eye Movement Desensitisation Reprocessing (EMDR)¹⁹. TF-CBT is based on the abovementioned theoretical understandings, adopting a dual focus to cognitive and behavioural change. To achieve change TF-CBT incorporates a variety of exposure techniques, cognitive restructuring, and anxiety control methods (Meadows & Foa, 1998). However, EMDR professes to work differently. During EMDR treatment clients are encouraged to access the trauma memory whilst simultaneously attending to a distractor task (e.g. therapist hand movements) which seemingly violates the fundamental principles of exposure and habituation requiring uninterrupted attention and sustained arousal respectively (Thompson & Spencer, 1996; Rothbaum, Astin, & Masteller, 2005). The EMDR literature suggests the therapeutic effects that result from an apparent counter-veiling process can be partly explained by the Working Memory (WM) hypothesis (van den Hout et al., 2010). In brief, retrieving memories requires WM resources that are limited, and competition for these resources when clients are encouraged to recall a dysphoric memory whilst performing a secondary task impairs the retrieval of the memory (van

¹⁹ See extended paper section 1.4.5 for discussion regarding the Adaptive Information Processing model that underpins EMDR therapy.

den Hout et al., 2011). The vividness and emotional tone of the trauma memory is attenuated leading to 'imagination deflation' and is thought to be reconsolidated in autobiographical memory in a less salient form leading to reductions in distress (Gunter & Bodner, 2008). Clinical findings utilising in-session memory ratings and analogue studies testing memory saliency offer support for the WM explanation (Andrade, Kavanagh, & Baddeley, 1997; Gunter & Bodner, 2008; Kemps & Tiggemann, 2007; van den Hout et al., 2010; Maxfield, Melnyk, & Hayman, 2008).

Despite seemingly divergent theoretical underpinnings both treatments have been subjected to controlled trials and have proven to be equally efficacious (Seidler & Wagner, 2006); however, EMDR has been described as more efficient due to the lower average treatment duration (van Etten & Taylor, 1998) with clinical trials usually involving eight sessions (Bae, Kim, & Park, 2015; van der Kolk et al., 2007) compared to 12–15 sessions of TF-CBT for 'typical' trauma cases (Cohen & Mannarino, 2015). Yet, it is important to reflect on the legitimacy of these findings. A meta-analysis of 26 controlled clinical trials reviewed the efficacy of trauma-focused therapies for PTSD (Bradley, Greene, Russ, Dutra, & Westen, 2005) and revealed reported rates of PTSD remission to include both partial and complete remission. Arguably, this misrepresents the efficacy of the therapy under study given participants with partial remission can still present with considerable PTSD symptoms. A further meta-analysis (Bisson et al., 2007) criticised controlled EMDR studies for only including data from treatment completers in their analysis, a strategy serving to inflate their results (Gaston, 2015). Moreover, real-world practice demonstrates a higher dropout and nonresponse rate for trauma-focused therapies compared to randomised controlled trials (RCT) which are subject to restricted conditions relating to exclusion/inclusion criteria (Najavits, 2015). Yet, there does not appear to be any systematic difference between the acceptability of trauma focused therapies when they are compared in the same study (Imel, Laska, Jakupcak, & Simpson, 2013). Additionally, there is a shortage of follow-up studies beyond one-year post-intervention examining the maintenance of treatment gains for both EMDR and TF-CBT, therefore, confident conclusions regarding long-term efficacy of either therapy would be spurious (Gaston, 2015; Shedler, 2010).

A recent addition to the trauma treatment arena is Brain Work Recursive Therapy (BWRT; Watts, 2014). Akin to EMDR, BWRT claims to be an information

processing, rather than an exposure, therapy (Shapiro, 2014; Watts, 2014).

Topographically, BWRT appears to share procedural elements compatible with EMDR, for example, the client is encouraged to focus on the traumatic memory while also attending to auditive stimuli (therapist speed talking). These seemingly competing tasks may qualify as the dual taxation apparent in EMDR. Furthermore, in BWRT there is an active discouragement of reciprocal dialogue between client and therapist or disclosure of trauma details. This is a probable strength of the approach given the tolerability of an intervention is key for trauma clients, where fears of exposure-related distress are often a concern and avoidant coping is commonplace (Pineles, et al., 2011). The theories underpinning each therapy are also conceptually different. BWRT postulates problematic neuronal pathways as the primary basis of clinical pathology. Put simply, the neuronal architecture of the brain initiates a 'best match' behavioural, cognitive and/or somatic response when incoming data from the environment is recognised. Value judgements as to whether this response is good or bad do not exist at the earliest stages of the neural pathway but are simply initiated for survival. Problems arise when the patterns of responding are unsuitable or no longer relevant to current life. BWRT is thought to intercept the pattern matching process and modify the processing instructions, essentially reprogramming a desired response. This explanatory account is based on extrapolations from the research of Benjamin Libet²⁰. Libet (1985) studied the temporal relationship between brain activity and conscious intent. He recorded participant's responses of a simple voluntary movement via an electroencephalogram (EEG) and found a time gap of several hundred milliseconds between unconscious neural activity and conscious decision making. This time gap has been substantiated by succeeding research (Fried, Mukamel, & Kreiman, 2011; Haynes, 2011; Haynes et al., 2007), yet, how findings from relatively simple decision-making tasks translate to tasks with greater motivational importance or complex reasoning remain untested (Haynes, 2011).

BWRT comprises of three levels that vary in treatment protocol and duration. Level 1 BWRT is recommended for 'common mental health problems' including milder

²⁰ See extended paper section 1.4.6 for further discussion on research by Benjamin Libet and succeeding authors.

forms of traumatic stress and is the focus of this paper; Level 2 is utilised for ‘core identity’ difficulties such as alcoholism or recurrent depression; and Level 3 is for ‘psychophysiological distress/ dysfunction’ linked to chronic physical illness. The protocol for Level 1 contains 14 stages (see Table 4 for stage descriptions), stages 4: ‘wait state’, 6: ‘moment of now’, and 8: ‘recursive looping’ are of particular interest given the apparent distinction to other therapy protocols and the assigned importance of these stages for successful resolution of psychological distress (Watts, 2014).

Table 4

BWRT treatment protocol (Version 1.0)

Stage	Description
Psychoeducation	Prior to starting the treatment protocol, the client is introduced briefly to the basic premise of how BWRT is thought to work. Verbal explanations are accompanied with visual illustrations of the brain and the contained neural networks.
Stage 1	The client is asked to identify their preferred/ hoped for response when confronted with their trigger situation. The preferred response needs to be plausible and fair, meet the needs of the client, and not involve harm to another.
Stage 2	The therapist ensures that the client can recall the troublesome memory or a memory of a time when they experienced the worst symptomatic response pertaining to their presenting difficulty. They do not have to feel the response, only remember that they felt it. This must be an <u>actual memory</u> , not a thought or a feeling, and the client is not required to share this in detail.
Stage 3	The therapist ascertains from the client their Perceived Arousal Level (PAL) on a 1 - 10 basis with 10 high, when recalling their chosen memory. If 8 or lower, it is advisable for the client to identify an alternative memory with higher associated arousal.
Stage 4	Create the Wait State. The client is invited to close their eyes, access the memory, ‘zoom in’ to the very worst moment of that memory and ‘freeze it’ as a static image.

Stage	Description
Stage 5	The client is asked to visualise ‘dragging’ their preferred response in front of their existing frozen memory. The preferred response will ideally be accompanied by visual imagery and the preferred emotional content. At this stage, the client is encouraged to think vividly of what they preferred to happen.
Stage 6	Create intensity for the ‘moment of now’. The treating therapist reads a scripted narrative in quick succession encouraging clients to adopt a ‘here and now’ focus and to visualise the new feeling generated by their preferred response entering their neural pathways and physical boundaries (i.e. skin and ‘aura’). Such imagery is prompted by illustrations of neural networks shown at the start of the session during psychoeducation provision.
Stage 7	Create the ‘future memory’. The treating therapist reads a short script with intensity, directing the client to visualise a time in the future where they are looking back at their BWRT session and realising what a success it has been.
Stage 8	Recursive looping. This involves the therapist reading a scripted narrative for a minimum of 6 times with increasing speed (230 words per minute) the content of which directs the client to shift their attention from memories of the past, present and future. The speed of reading is considered essential to sufficiently overwhelm the central nervous system and prevent other extraneous information from being processed that could interrupt the installation of the new neural route representing the ‘preferred response’.
Stage 9	The resting phase. The client is encouraged to relax in silence for up to two minutes.
Stage 10	The consolidation phase. The therapist engages the client in ordinary conversation avoiding any discussion of the session to allow the brain to process the new data without interruption.
Stage 11	The debriefing phase. To ensure the clients preferred response meets the three-criterion outlined in stage 1, the client is encouraged to share in sufficient detail what their preferred response looks like.

Stage	Description
Stage 12	PAL re-rated. The therapist will ascertain the clients PAL rating when recalling the target memory. If the PAL is >3 then further recursive looping is required.
Stage 13	The client is asked to try and ‘fire up’ their original response to their target memory. If any unwanted physiological or emotional responding remains further processing/ looping is required.
Stage 14	Maintenance of treatment gains. If the client is revisited by any of the unwanted responses associated with their target memory, they are encouraged to visualise their preferred response and boundaries (i.e. skin and aura) which is thought to reactivate the preferred neural route.

Despite the absence of controlled research, BWRT is currently being used by private and NHS clinical psychologists working with diverse conditions such as Chronic Fatigue Syndrome (CFS), Generalised Anxiety Disorder, and PTSD (Waters, 2017). Seemingly clinical applications have overtaken the empirical validation of the model; a common phenomenon among nascent therapies (Marriott & Kellett, 2009). However, anecdotal reports appear positive, even with brief interventions (A. Abey, personal communication, June 22, 2017). Practice-based evidence generated from routine practice is arguably more clinically representative when compared to RCTs that exclude clients for methodological reasons (Pilgrim, 2011), however, we have a duty to ensure that the treatments we offer are safe and effective, and to demand empirical scrutiny. Although EMDR and TF-CBT are both evidence-based treatments with a substantiated body of research supporting their use, neither are a panacea for all trauma related difficulties, and their tolerability and longevity of effects remain questionable. Subsequently, the development of alternative trauma therapies is both welcome and warranted. However, questions remain regarding if, and how, BWRT works, therefore, this current study is considered an important piece of work towards the efficacy and evidence development of this nascent therapy.

Aims

This study aimed to investigate the following three questions:

- Is Level 1 BWRT effective in treating non-complex trauma?
- Can the mechanism(s) of change in BWRT be elucidated through process measures?
- How do participants experience BWRT?

Morphological changes in neurons and brain function are a widely accepted outcome of psychological intervention (Brooks & Stein, 2015), however, in a naturalistic setting the internal theory proposedly underpinning BWRT is difficult to both operationally define and measure. Yet, several mechanisms of action may be interacting to achieve these therapeutic effects, which informed the focus of the current study.

This exploratory study utilised a multiple single-case experimental design (SCED) and implemented a psychosomatic, mixed-method approach. Physiological and psychological instruments were utilised to aid exploration of BWRT effectiveness and treatment mechanism(s). Heightened physiological reactivity is a hallmark symptom of traumatic stress (APA, 2013) and arousal reductions are a largely accepted outcome of exposure and habituation processes (Benito & Walther, 2015). Therefore, physiological monitoring was undertaken to investigate whether habituation processes were present, in addition to vagal shifts reflecting changes between socially affiliative and threat-defensive responses. Within-session HR deceleration and increased HRV recordings indicating decreased physiological arousal and increased parasympathetic activity respectively, could offer evidence for this (Thayer, Friedman, Borkovec, Johnsen, & Molina, 2000). Conversely, to investigate the possibility of dual taxation of WM resources as identified in the EMDR literature, within-session memory ratings were included to assess emotionality and vividness attenuation of the target memory. Change interviews (Elliott, 2002) were also conducted to yield further data regarding participants' experience of receiving BWRT and contextualise quantitative findings, alongside Interpersonal Process Recall (IPR; Timulák & Lietaer, 2001) of selected protocol stages (see Method section).

Hypotheses

If BWRT alleviates trauma symptomology as theorised, we would expect a marked reduction on the traumatic stress measure succeeding treatment. If BWRT shares procedural elements of dual taxation on WM as theorised, we would expect within-session reductions on memory vividness and emotionality ratings. If the effects of BWRT lead to trauma resolution as theorised, we would expect a concomitant increase in HRV taken at follow-up. No further hypotheses were made.

Given BWRT is a relatively un-researched area the utility of the SCED to produce a rich data set for each participant, offer the demonstration of effects within and between participants, mitigate concerns of internal validity (Kazdin, 1981), and offer a greater understanding of change mechanisms in novel treatments (Ray, 2014) was together considered a key advantage of this method.

Method

Ethics²¹²²

This research was approved by the University of Lincoln Research and Ethics Committee, the NHS Trust Ethics Committee and the Cambridgeshire and Hertfordshire Research Ethics Committee (REC Ref 17/EE/0056/AM01). In brief, participants provided informed consent, and were aware of their right to withdraw from the study at any stage without any impact on their treatment with the service.

Design²³

A multiple mixed methods SCED with repeated measurement was utilised. An A-B design was adopted (Barlow, Nock, & Hersen, 2008) which included baseline, intervention, consolidation and two follow-up phases, at one-month and two-months post-intervention for each participant to evaluate the stability of any effects. Participants

²¹ See extended paper section 2.7 for further discussion on ethical considerations within this study.

²² See Appendix D for ethics documentation.

²³ See extended paper sections 2.1 and 2.2 for further discussion regarding epistemological position and SCED methodology respectively.

started the intervention phase at different time points, satisfying the (non-concurrent) multiple-baseline design (Smith, 2012).

Participants

Six participants were chosen to meet replication criteria recommended by Clearinghouse (Kratochwill et al., 2010), and also publication norms (Smith, 2012). Participants were recruited from an established Physical Health service in the UK via advertisement from clinicians working within the service who made first contact with potential participants. Participants were recruited following treatment as usual (TAU), which consists of a 10-week psycho-educational group programme regarding the interrelationship between physical and mental health, with a focus on CFS. Following TAU, clients that report residual issues related to poor mental health are offered BWRT. Clients who reported difficulties related to trauma were offered BWRT as normal, in addition to the offer to receive BWRT as part of the study. Eight people expressed interest; two were considered unsuitable due to the complexity of the trauma presented (e.g., childhood sexual abuse). The second stage required potential participants to attend a screening appointment with the lead researcher to determine study eligibility against inclusion²⁴ criteria²⁵:

1. ≥ 18 years of age.
2. To have received treatment as normal.
3. Exposed to, or currently experiencing difficulties related to a non-complex traumatic event²⁶.
4. Score ≥ 8 on the Impact of Events Scale – 6 (IES-6²⁷; indicates traumatic stress symptomology further detail provided below).
5. English speaker, with good comprehension (determined by researcher's judgement at screening).

²⁴ See extended paper 2.3 for further discussion of participant inclusion and exclusion criteria.

²⁵ See Appendix E for participant information sheet given to participants at screening.

²⁶ For this study non-complex trauma encompasses non-qualifying stressors such as bullying and single-event trauma's such as a traumatic birth that are isolated to a single incident, with both referent trauma's having had a lasting negative impact on the individual's psychological health. For further discussion on the conceptualisation of trauma see extended paper section 1.1.

²⁷ See Appendix F for IES-6 measure.

6. Able to provide informed consent to participate throughout the research.
7. Not currently receiving, or due to receive, psychotherapy beyond the study intervention.
8. Consent for GPs to be notified of participant involvement in the research²⁸.

Demographics

Written informed consent²⁹ was obtained from each participant prior to the study commencing. Five participants were female, one was male; ages ranged between 27 years and 45 years (mean = 36 years, SD 7.4). Gender disparity in this sample was reflective of the service's client base. An overview of all participants is provided in Table 5.

²⁸ See Appendix G for GP letter.

²⁹ See Appendix H for participant consent form.

Table 5

Participant demographics

Variables	Participant 1	Participant 2	Participant 3	Participant 4	Participant 5	Participant 6
Source of Reported Trauma	Childhood bullying (38 years ago)	Unexpected bereavement (father; 5 years ago)	Assault at work and reporting of incident (20 years ago)	Childhood bullying (15 years ago)	Harassment and intimidation (one perpetrator; one year ago)	Traumatic birth (7 years ago)
Age	43 years	48 years	45 years	27 years	38 years	40 years
Gender	Female	Female	Male	Female	Female	Female
Marital Status	Single	Married	Married	Engaged	Married	Married
Past Therapy Experience[†]	Bereavement counselling; Non-specific counselling (5 years ago)	None	Hypnotherapy 12 years ago	Counselling (4 years ago)	Counselling (15 years ago); Interpersonal psychotherapy (1.5 years ago). Community psychiatry care (period of 15 years)	CBT (5.5 years ago); EMDR (4 years ago); CBT (1 year ago)

Variables	Participant 1	Participant 2	Participant 3	Participant 4	Participant 5	Participant 6
Psychotropic Medication	Anti-depressants prescribed approx. 12 years	None	None	None	Antidepressant; antipsychotic prescribed approx. 10 years	Antidepressant prescribed approx. 2.5 years

Note. †Past therapy experience excludes TAU which all participants received within the service prior to participation in the study. Five participants had previously received therapy either for the trauma identified in this study, for secondary mental health problems that had developed as a result of the trauma, or for unrelated psychological distress.

Measures

Quantitative Measures.³⁰

Measures were selected on the basis of their focus (e.g., trauma severity), psychometric properties, and their utility for repeated administration. The IES-6 (Thoresen et al., 2010) functioned as the dependant variable to assess the effectiveness of the BWRT intervention and was used to establish a baseline of traumatic stress. Further outcome measures were the Hospital Anxiety and Depression Scale (HADS; Zigmond & Snaith, 1983) and the Short Form Health Survey (SF-12; Ware, Kosinski, & Keller, 1996). A short-form version of the HADS (HADS-4)³¹ was also collected during baseline to provide a measure of psychological distress that could be tracked from baseline to follow-up. Process measures included within-session memory ratings³² and HR/HRV recordings which offered a dual function as a process and outcome measure. Measurement details, including frequency of administration are provided in Table 6. The wording of measures was slightly adapted according to the time period to which the measure referred (e.g., During the last week...). Measures were hosted on a secure server (Qualtrics) that was accessible remotely for participants to complete. Exceptions were the screening meeting, therapy session, and follow-up interview where paper copies of the measures were provided.

Heart rate variability.

HRV was recorded using the Polar RS800CX, consisting of a chest strap transmitter and wrist watch receiver. The Polar RS800CX is an updated version of the Polar S810 Heart Rate Monitor (HRM) which demonstrated excellent agreement with electrocardiographic (ECG) measures (Gamelin, Baquet, Berthoin, & Bosquet, 2008; Sandercock, Shelton, Bromley, & Brodie, 2004; Weippert et al., 2010). Therefore, it was assumed the RS800CX measurement process and data output pertaining to HRV remained valid.

To minimise anticipatory anxiety, a detailed explanation of the fitting instructions was supplied affording participants privacy to complete the procedure

³⁰ See extended paper section 2.4 for further discussion on measures chosen.

³¹ See Appendix I for HADS-4 questions.

³² See Appendix J for within-session memory ratings scale.

alone. Patterns of cardiac activity were monitored during a 10-minute baseline at screening, in vivo for 25-65 minutes during the therapy session, and a further 10 minutes at the one-month follow-up. At baseline and follow-up participants occupied a day-hospital quiet room while recordings took place to ascertain accurate data reflecting calm state HRV.

Change interview³³.

At the one-month follow-up, Interpersonal Process Recall (IPR; Timulák & Lietaer, 2001) was conducted for approx. 15-20 minutes with each participant. This involved playing back to participants brief audio segments from the therapy session, specifically the *wait state*, *moment of now*, and *recursive looping* of the BWRT protocol (Watts, 2014). Questions were asked pertaining to the participant's thoughts, feelings and physiology, including any notable thoughts/responses towards the treating therapist. This provided further insight into the possible in-therapy processes that brought about change, or lack thereof for participants. Following, a change interview³⁴ (Elliott, Slatick, & Urman, 2001) was conducted by the lead researcher to augment the collected quantitative data, and garner participant's general experiences of receiving BWRT.

³³ See extended paper section 2.6 for additional information on the change interview.

³⁴ See Appendix K for interview schedule for change interview.

Table 6

Measures completed

Measure (Author)	Description	Properties	Time/ Frequency
Impact of Events Scale-6 (IES-6; Thoresen et al., 2010).	<p>IES-6 measures the principal aspects of post-traumatic stress identified by the literature and has been tested in a wide variety of trauma populations to good effect (Arnberg, Michel, & Johannesson, 2014; Giorgi et al., 2015; Naghavi, Shabestari, & Alcolado, 2013; Thoresen et al., 2010).</p> <p>Five-point response scale; 'not at all' (0) to 'extremely' (4).</p> <p>Example item: 'I feel watchful and on guard'</p>	<p>Good construct and convergent validity (Giorgi et al., 2015; Thoresen et al., 2010).</p> <p>Very good internal consistency; $\alpha = .80$ for the total scale (Thoresen et al., 2010); acceptable internal reliability for post-traumatic dimensions, 0.69 for avoidance, 0.78 for arousal, and 0.78 for intrusion (Giorgi et al., 2015).</p> <p>Applying the cut-off level 8 was considered to have the best overall efficiency (sensitivity 0.92, specificity 0.84) and yielded a discriminant ability of 0.88 (Thoresen et al., 2010) when compared to the PTSD Checklist (Weathers, Litz, Herman, Huska, & Keane, 1993).</p>	<p>Screening Baseline (bi-weekly) Pre-intervention Consolidation (weekly) One and two-month follow-ups</p>

Measure (Author)	Description	Properties	Time/ Frequency
Hospital Anxiety and Depression Scale (HADS; Zigmond & Snaith, 1983).	<p>HADS functions as a domain specific Quality of Life (QoL) measure. The anxiety and depression questions are interspersed within the questionnaire yet are scored separately.</p> <p>Four-point response scale; Absence of symptoms (0) to maximum symptoms (3).</p> <p>Example item: 'Worrying thoughts go through my mind'</p>	<p>Excellent construct and convergent validity (Kemp et al., 2010)</p> <p>Good internal consistency; $\alpha = .82$ anxiety subscale; $\alpha = .77$ depression subscale (Crawford, Henry, Crombie, & Taylor, 2001); Very good test retest reliability; .86 (Spinhoven et al., 1997).</p>	<p>Screening Pre-intervention Consolidation (weekly) One and two-month follow-ups</p>
Adapted HADS Short-Form (HADS-4; Created for this study)	<p>Two highest loading items with adequate face validity for depression and anxiety subscales were selected. Questions 2 and 4, and 5 and 9 respectively.</p> <p>Four-point response scale; Absence of symptoms (0) to maximum symptoms (3). Example item: 'I still enjoy things I used too'</p>	<p>Short-Form measure created to minimise participant burden at baseline when measures were collected bi-weekly.</p> <p>Poor internal consistency; $\alpha = .47$ determined from sample responses.</p>	<p>Baseline (bi-weekly)</p>

Measure (Author)	Description	Properties	Time/ Frequency
Short Form Health Survey (SF-12, Version 1; Ware et al., 1996)	The SF-12 functions as a general measure of QoL and distinguishes between mental and physical health (De Smedt et al., 2013).	Excellent to good construct, convergent, discriminant and criterion validity (De Smedt et al., 2013).	Screening Pre-intervention One and two-month follow-ups
	Three, five, and six-point Likert scales; i.e. 'not at all' (0), 'yes, limited a little' (2). Higher scores indicate higher levels of health.	Good internal consistency; .89 Physical Component Scale; Acceptable internal consistency; .76 Mental Component Scale (McHorney, Kosinski, & Ware, 1994; Ware et al., 1996).	
	Example item: 'How much during the past 4 weeks have you felt calm and peaceful?'		
Ratings of Vividness and Perceived Levels of Arousal (PALs; Watts, 2014) of Target Memory.	In-session measures to assess alterations to target memory.	Comparable ratings present in EMDR literature as a by-proxy measure of WM dual taxation considered to alter the reconsolidation of the target memory.	Intervention
	Items: 'When you think about the memory how strong emotionally does it feel?'		
	'How vivid is the memory when you are looking at it?'		

Measure (Author)	Description	Properties	Time/ Frequency
Heart Rate Variability (HRV) Polar RS800CX Heartrate Monitor (HRM)	<p>HRV is a non-invasive computerised measure of physiological responsivity (Frustaci et al., 2010).</p> <p>Measures HRV through chest strap transmitter and wrist watch receiver.</p> <p>In accordance with Task Force (1996) and more recent recommendations for short-term recordings (Laborde, Mosley, & Thayer, 2017; McCraty & Shaffer, 2015), measurements for both time and frequency domains of HRV were provided.</p>	Excellent agreement with ECG measures (Gamelin et al., 2008; Sandercock, et al., 2004; Weippert et al., 2010).	<p>Screening</p> <p>Intervention</p> <p>One-month follow-up</p>

Measure (Author)	Description	Properties	Time/ Frequency
Interpersonal Process Recall (IPR; Timulák & Lietaer, 2001); Change Interview (Elliott et al., 2001)	<p>IPR involves playing back audio segments of interest from the therapy session for participants to comment on any unspoken thoughts and feelings at the time.</p> <p>The change interview consists of a semi-structured interview schedule ascertaining qualitative information about the process and outcome of therapy for participants.</p> <p>Interview questions were designed to promote discussion in a non-leading manner.</p>	Change interviews were able to offer support or refute the validity and reliability of the quantitative measures (Elliott et al., 2001).	One-month follow-up

Procedure

Baseline.

Typically, in SCED research baselines against which change is assessed are protracted until stability of the dependent variable is reached (i.e. IES-6) or there is a trend indicating worsening symptoms prior to intervention (Lane & Gast, 2014). However, the deliberate delaying of treatment for participants raises ethical concerns. Consequently, baseline measures were completed for a minimum of two weeks to achieve the recommended three to five data points prior to the implementation of the intervention (Lane & Gast, 2014). The study design allowed for two follow-up opportunities to track future changes. In addition, methods not dependent on stable baselines were utilised in the analysis (e.g., Percentage of data exceeding the median; PEM)

Intervention.

Participants were provided with Level 1 BWRT. Level 1 is recommended for non-complex trauma (Watts, 2014), with practice-based evidence suggesting that sustained improvement could be expected in a single session. However, the intervention phase could be extended if a clinical need was identified. Participants would remain in the study if extended sessions continued at Level 1. All the sessions were audio-recorded. All therapists were trained at a minimum of Level 1 with one or more years' experience using BWRT, and two therapists had additional Level 2 BWRT training. A fidelity check of therapist adherence to the BWRT protocol was performed. Fifty percent of the recordings were checked (one full session per therapist) chosen at random. Recordings were checked against the protocol, with additional checks of theoretical concordance and divergence. There was 100% inter-rater reliability between the reviewers. Both reviewers concluded treatment fidelity had been upheld and therapist competence was sufficient. Table 4 provides the stage and corresponding description of the BWRT protocol.

Consolidation.

Participants completed a weekly battery of measures for a period of three weeks following the therapy to assess the effect of the intervention on traumatic stress symptoms and general psychological wellbeing (see Table 6).

Follow-up.

First follow-up.

IPR and change interviews were undertaken approx. one month following participant's completion of therapy. Interviews were audio recorded for later qualitative analysis. Participants repeated the full battery of measures and a short-term recording of HRV was taken. At the end of the meeting, participants were thanked for their time, and provided with a debrief letter³⁵ detailing their participation in the study and a reminder of the final online battery of measures to be completed in one months' time.

Second follow-up.

All participants completed one final battery of measures approx. two months after completing their therapy. Both follow-ups allowed the researcher to assess whether any change was sustained or whether intervention effects were cumulative. See Figure 2 for an outline of the procedure.

³⁵ See Appendix L for participant debrief letter.

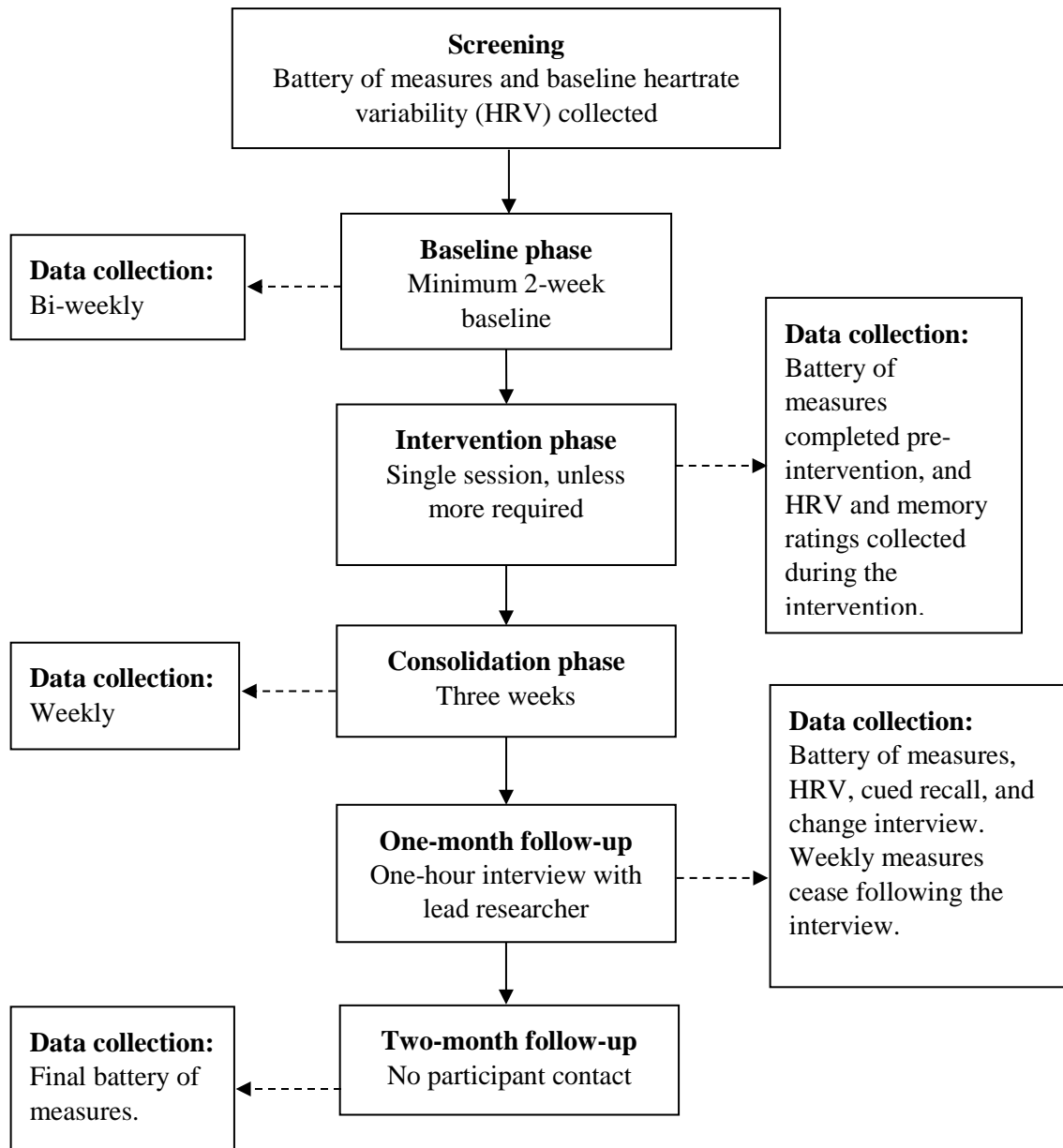


Figure 2. Flow chart of study procedure.

Analysis

Visual analysis remains the preferred and traditional method of data analysis in SCED research (Kratochwill et al., 2010; Ray, 2014; Vannest, Davis, & Parker, 2013). Quantitative results for the IES-6 and HADS-4 were graphed and analysed using visual analysis procedures informed by Lane and Gast (2014). Graphs were inspected with regards to central tendency, trend, variability, and point of change. After baseline data collection the HADS-4 items were extrapolated from participant's scores on the full HADS measure to enable the tracking of changes over time.

To calculate treatment effect size, the PEM (Ma, 2006) in which the median value of the baseline data is the referent, was used on the IES-6 and HADS-4 data. In conjunction the Fisher, Kelley, and Lomas (2003) dual criterion (DC) was implemented, meaning the number of data points in the intervention and follow-up phases below both the median, and projected trend line, were counted. The DC method is considered to result in fewer Type 1 errors and have greater power to detect real treatment effects. PEM scores have a range of 0 to 1. Scores $\geq .9$ indicate a 'highly effective treatment'. Scores between, .7 and .9, and scores $< .7$, indicate 'moderately effective' and 'questionable or not effective' treatments respectively (Ma, 2006).

To determine whether any recorded changes were considered reliable (beyond what could be attributed to chance or measurement error at 95% confidence), and clinically significant (participant lies within a non-clinical range), Jacobson and Truax's (1991) Reliable Change Index (RCI) and Clinically Significant Change methods (CSC) were applied respectively³⁶³⁷. Given the in-session memory ratings were a subjective measure to detect idiographic change during treatment and the HADS-4 was an abbreviated version of the full HADS, neither measure were subjected to RCI or CSC analysis. However, these data were graphed and inspected for change.

³⁶ See extended paper 2.8 for further discussion on Jacobson and Truax's (1991) criteria for assessing reliable and clinically significant change, including the referent data used to perform calculations.

³⁷ To achieve CSC, participants must have a pre-treatment score in the clinical range, and their pre-post change must be greater than the RCI value.

HRV data was analysed on five-minute-long segments of HR recordings. Segments were selected a minimum of two minutes after recordings had started to minimise the impact of noise interference and allow participants HR to stabilise. Error correction procedures were performed (a tool provided by the Polar ProTrainer5 software), corrected to a 'moderate' degree for each set of data. For some reports, no artefacts or corrections were identified. HR data was visually inspected using graphical representations generated by the software, and the following HRV indices extrapolated. Time-domain HRV variable, the square root of the mean of the sum of the squares of differences between adjacent R-R intervals (R-MSSD) and the frequency domain data, high frequency (HF; 0.15–0.40 Hz) reported within recommended frequency bandwidths (Task Force, 1996).

There remains limited consistency between authors regarding how and what to present when reporting short-term measures of HRV (Laborde et al., 2017; Nunan et al., 2010). Interpretations were concentrated on R-MSSD and HF in line with more recent recommendations³⁸ (Laborde et al., 2017; McCraty & Shaffer, 2015), due to increasing criticism and ambiguity surrounding the physiological underpinnings of the low frequency and LF/HF ratio, lowering its predictive power as a measurement of psychophysiological phenomena (Billman, 2013).

R-MSSD and HF reflect vagal tone and self-regulatory capacity, and are both highly correlated (McCraty & Shaffer, 2015). Yet, comparatively R-MSSD is relatively free of respiratory influences (Shaffer, McCraty, & Zerr, 2014). Higher values in both measures indicate higher HRV and parasympathetic activity (Laborde et al., 2017). HRV indices were not subject to RCI or CSC calculations due to an absence of normed data (Nunan et al., 2010).

Analysis of participants qualitative responses generated from the IPR and change interview were informed by Framework Analysis (FA; Ritchie & Spencer, 1994). FA was used to summarise the data which was then considered alongside quantitative findings, in order to strengthen or refute inferences regarding the effect and/or possible change mechanism(s) present in BWRT. Inspection of change

³⁸ See extended paper section 3.1 for all pre- and post-treatment HRV indices recommended by Task Force (1996).

interviews also permitted the consideration of extraneous factors to the therapy process and their potential influence on treatment outcome.

Results³⁹

No participants dropped out of the study, however, one participant did experience a temporary hospital admission due to a deterioration in her mental health. For this reason not all follow-up measures were collected, and the change interview with that participant was conducted three months post-intervention. The duration of the intervention sessions ranged from 20 to 55 minutes across participants.

Visual Analysis of Change

Time-series data collected from the repeated IES-6 and HADS-4 were graphed and visually inspected for change across phase and time (see Figure 3-8). The treatment effect size was calculated for each participant using the DC (Fisher et al., 2003) method and within-session process measures were also graphed for inspection.

³⁹ See extended paper section 3.2 for a summary of results per participant.

Participant 1

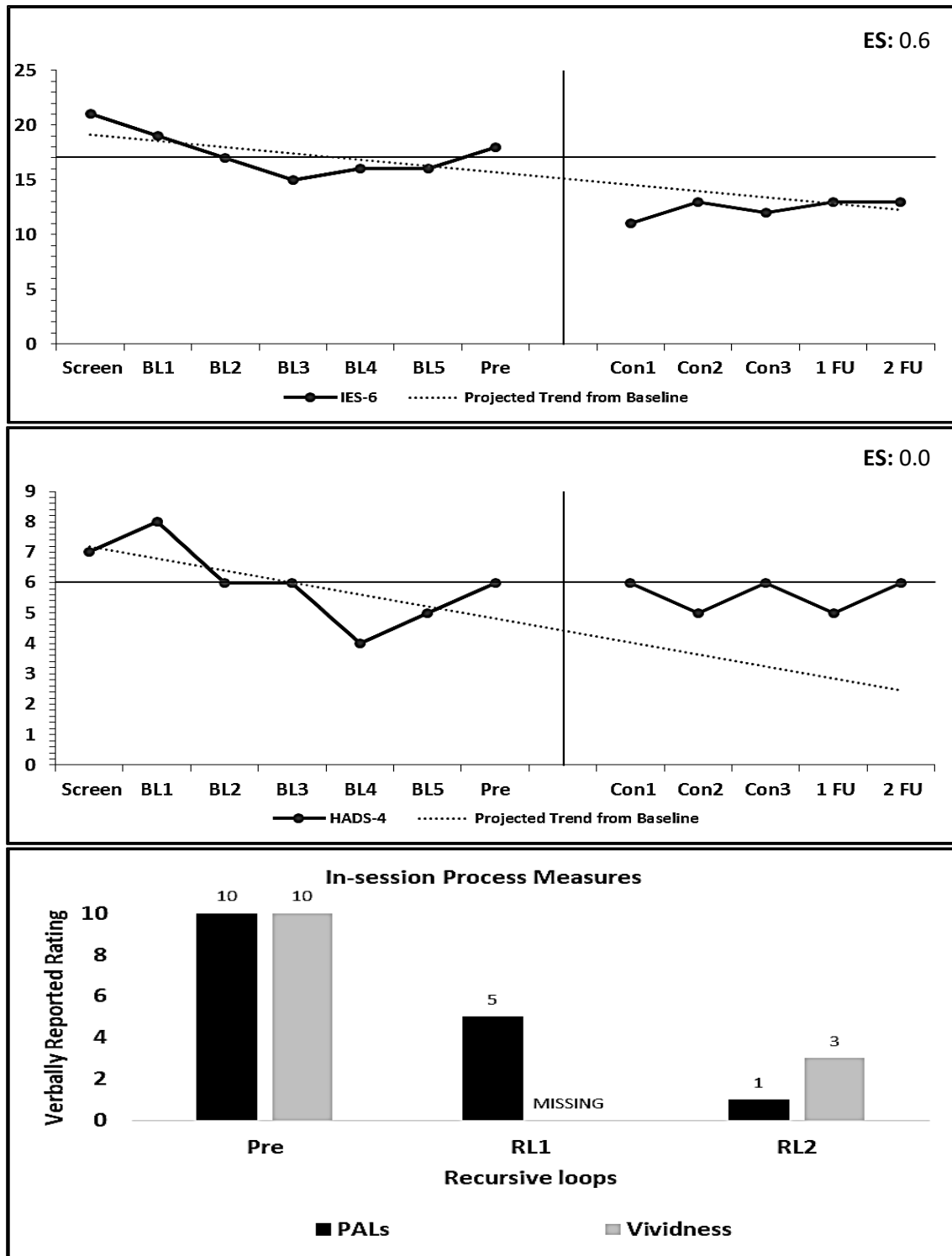


Figure 3. Participant one's graphed time-series data with accompanying effects sizes and in-session process measures. Baseline median indicated by solid line. Screen: Score at time of entering study; BL: Baseline (measures collected every three days); Pre: Pre-intervention (measures collected immediately before BWRT session); Intervention illustrated via vertical solid line (one session); Con: Consolidation (measures collected weekly post-intervention); FU: Follow-up (measures collected at 1 and 2 months post-intervention); ES: Treatment effect size; PALs: Perceived Levels of Arousal; RL: Recursive Loop.

Participant 2

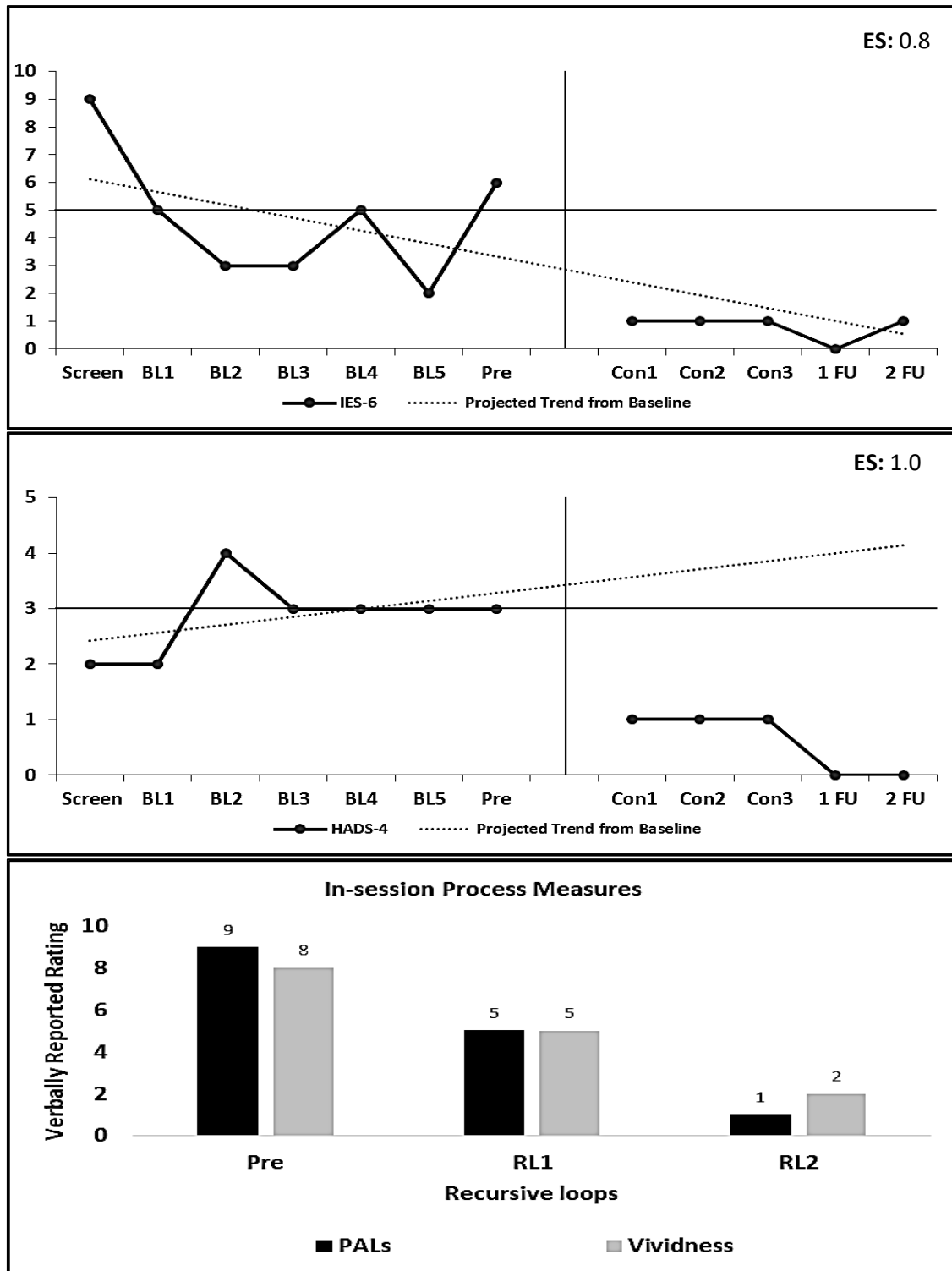


Figure 4. Participant two's graphed time-series data with accompanying effects sizes and in-session process measures. Baseline median indicated by solid line. Screen: Score at time of entering study; BL: Baseline (measures collected every three days); Pre: Pre-intervention (measures collected immediately before BWRT session); Intervention illustrated via vertical solid line (one session); Con: Consolidation (measures collected weekly post-intervention); FU: Follow-up (measures collected at 1 and 2 months post-intervention); ES: Treatment effect size; PALs: Perceived Levels of Arousal; RL: Recursive Loop.

Participant 3

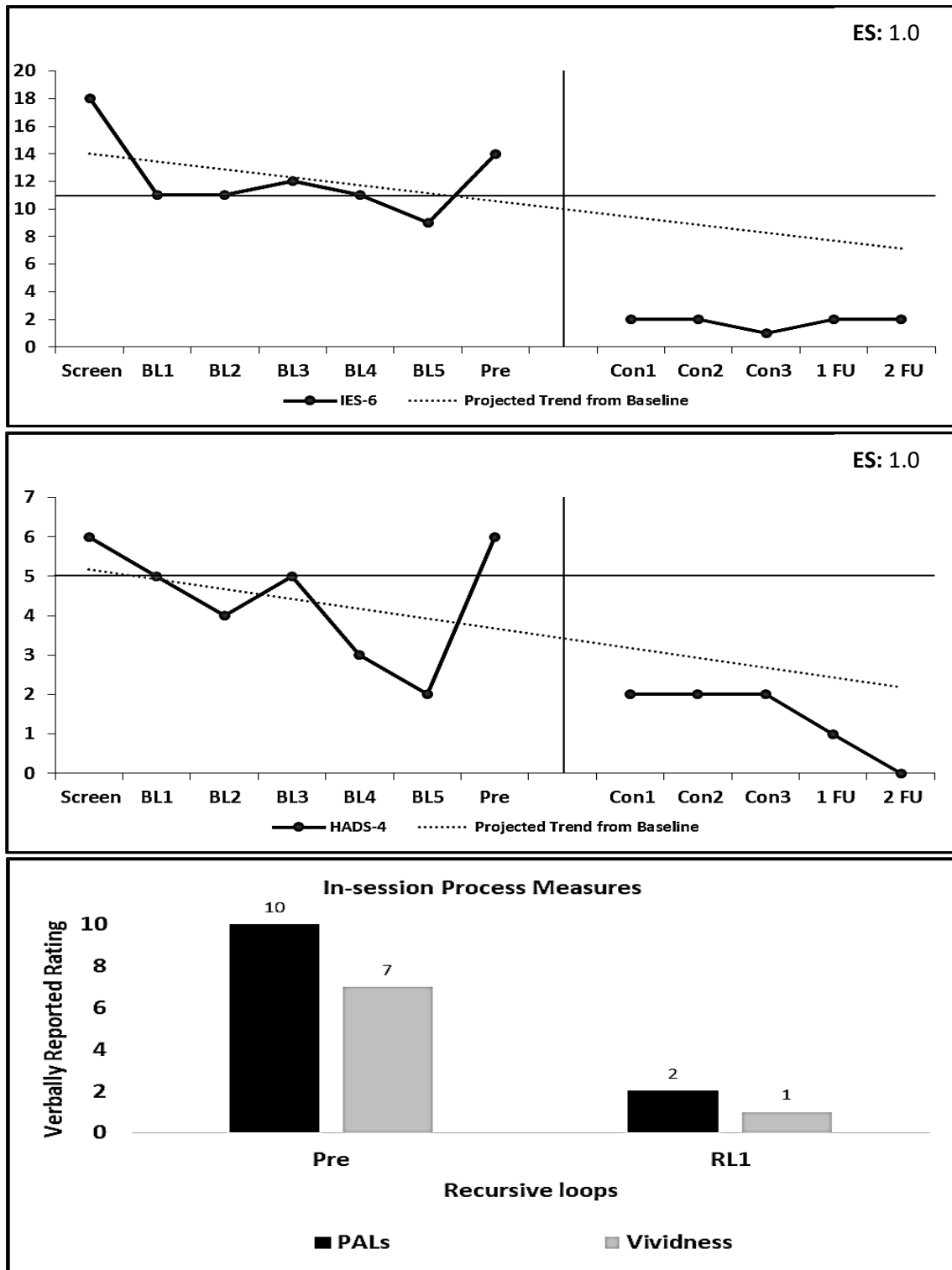


Figure 5. Participant three's graphed time-series data with accompanying effects sizes and in-session process measures. Baseline median indicated by solid line. Screen: Score at time of entering study; BL: Baseline (measures collected every three days); Pre: Pre-intervention (measures collected immediately before BWRT session); Intervention illustrated via vertical solid line (one session); Con: Consolidation (measures collected weekly post-intervention); FU: Follow-up (measures collected at 1 and 2 months post-intervention); ES: Treatment effect size; PALs: Perceived Levels of Arousal; RL: Recursive Loop.

Participant 4

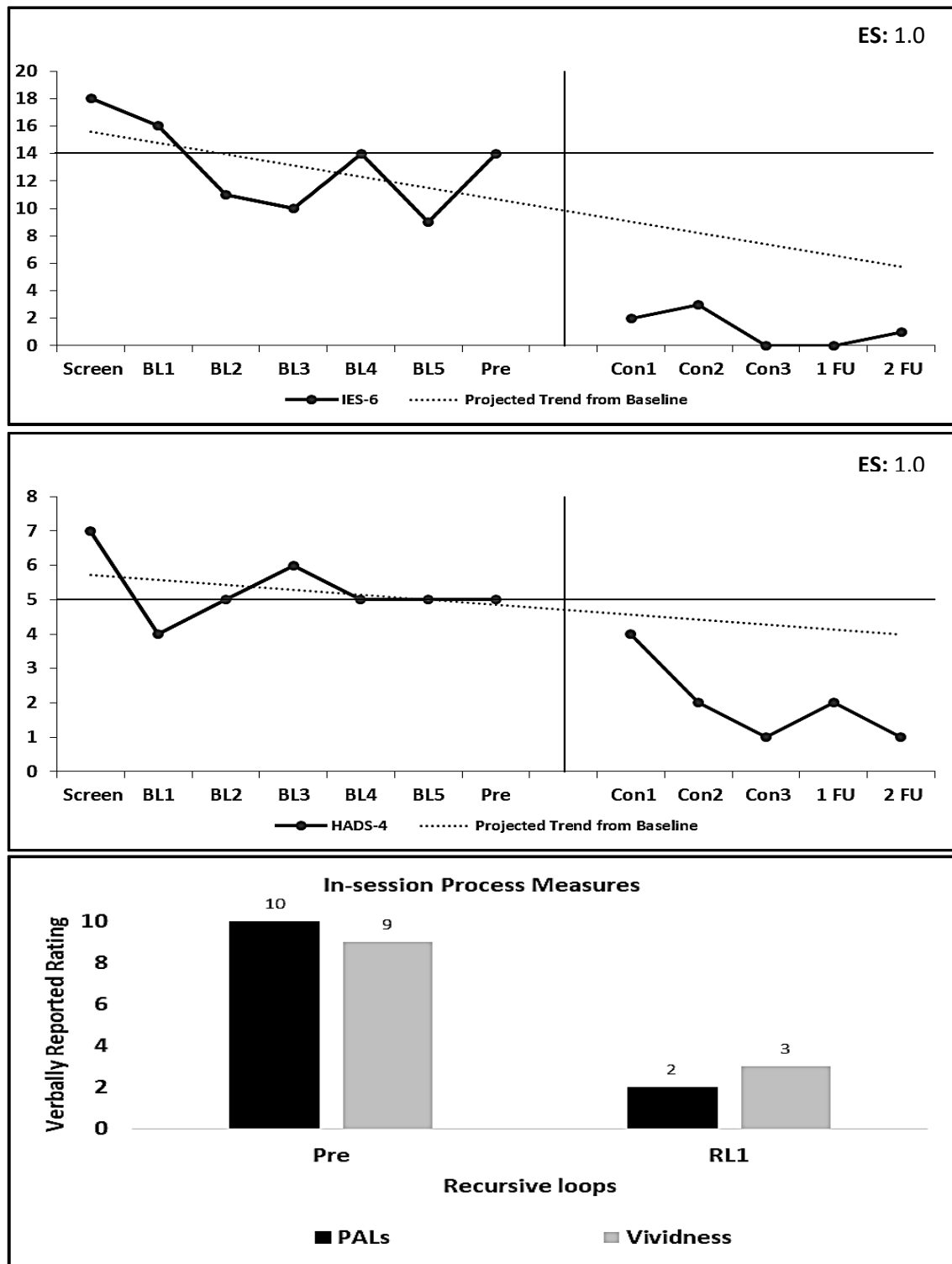


Figure 6. Participant four's graphed time-series data with accompanying effect sizes and in-session process measures. Baseline median indicated by solid line. Screen: Score at time of entering study; BL: Baseline (measures collected every three days); Pre: Pre-intervention (measures collected immediately before BWRT session); Intervention illustrated via vertical solid line (one session); Con: Consolidation (measures collected weekly post-intervention); FU: Follow-up (measures collected at 1 and 2 months post-intervention); ES: Treatment effect size; PALs: Perceived Levels of Arousal; RL: Recursive Loop.

Participant 5

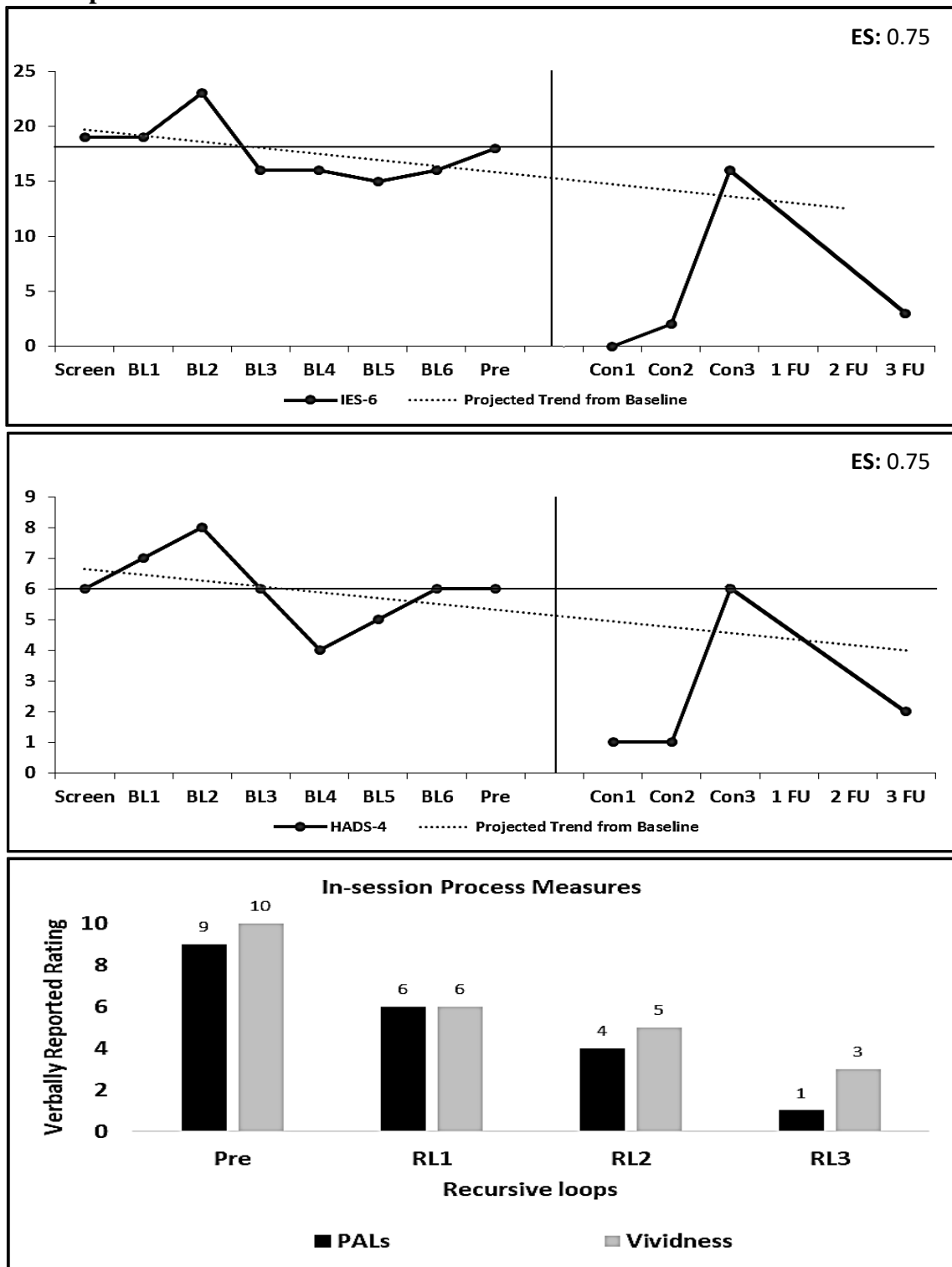


Figure 7. Participants five's graphed time-series data with accompanying effect sizes and in-session process measures. Baseline median indicated by solid line. Screen: Score at time of entering study; BL: Baseline (measures collected every three days); Pre: Pre-intervention (measures collected immediately before BWRT session); Intervention illustrated via vertical solid line (one session); Con: Consolidation (measures collected weekly post-intervention); FU: Follow-up (measures collected at 1 and 2 months post-intervention); ES: Treatment effect size; PALs: Perceived Levels of Arousal; RL: Recursive Loop.

Participant 6

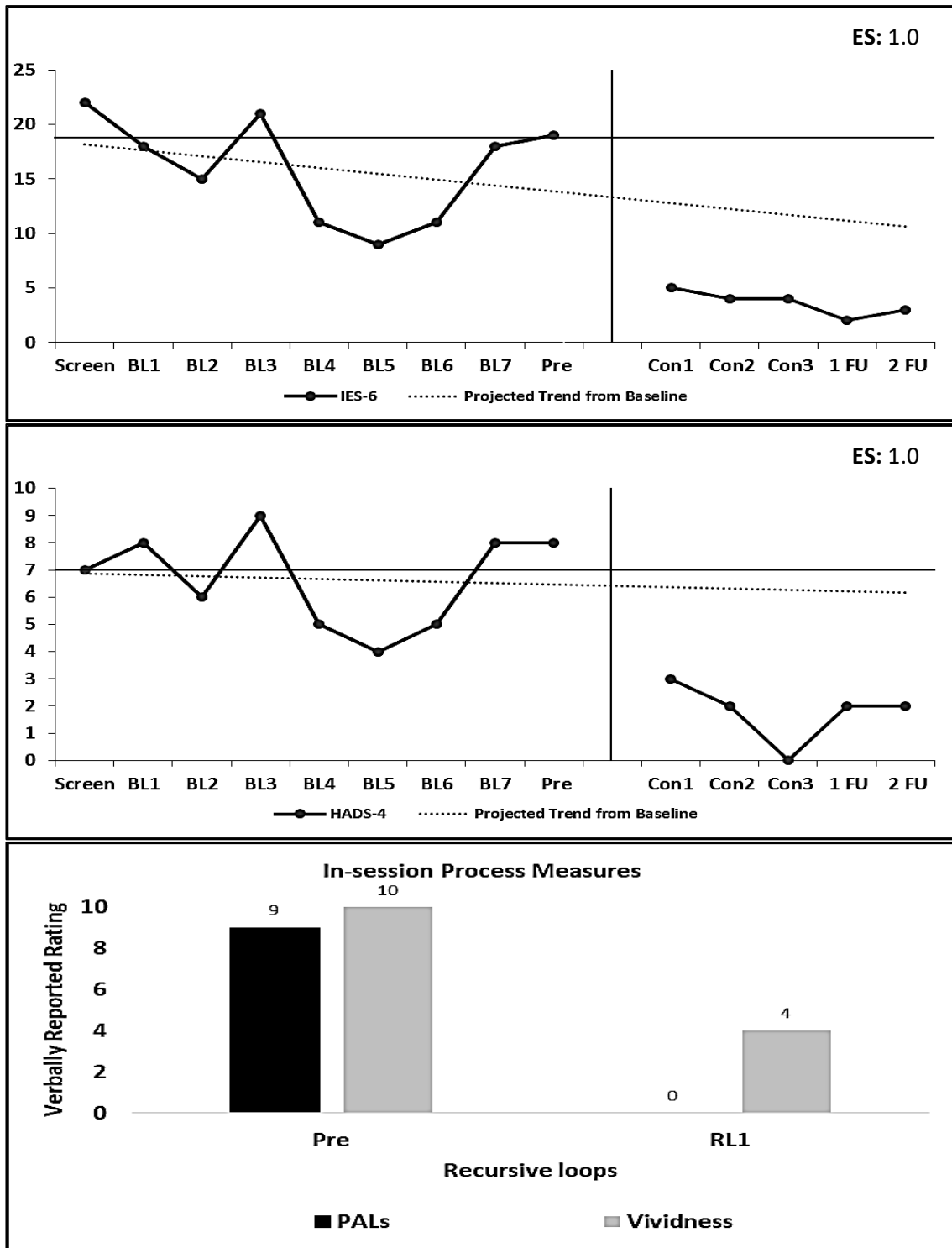


Figure 8. Participant sixes graphed time-series data with accompanying effects sizes and in-session process measures graphed for visual inspection. Baseline median indicated by solid line. Screen: Score at time of entering study; BL: Baseline (measures collected every three days); Pre: Pre-intervention (measures collected immediately before BWRT session); Intervention illustrated via vertical solid line (one session); Con: Consolidation (measures collected weekly post-intervention); FU: Follow-up (measures collected at 1 and 2 months post-intervention); ES: Treatment effect size; PALs: Perceived Levels of Arousal; RL: Recursive Loop.

Traumatic Stress (IES-6)

Across participants baseline data was variable, with stability or deterioration demonstrated for only one to three data points prior to the introduction of the intervention. However, overall comparisons between projected and actually obtained data suggest an immediacy of effect regarding reductions in traumatic stress measurement following the BWRT intervention. With the exception of participant one and two, noted improvement has exceeded the projected baseline median and trend. Treatment gains were maintained at one- and two-month follow-ups for participants two, three, four, and six suggesting durability of improvements. Participant one remained in the clinical range for traumatic stress throughout data collection, and participant five experienced a transient return to baseline levels of functioning following a psychotic episode, however, treatment gains related specifically to the trauma had been restored at a three-month follow-up. Three participants yielded scores suggesting 'highly effective treatment', two participants 'moderately effective' and one participant 'questionable or not effective treatment'. For RCI and CSC on recorded changes see Table 7.

Psychological Distress (HADS-4)

Overall, psychological distress appeared to positively co-vary with changes on the IES-6 across phases. Here, treatment gains appeared to show more of a gradual improvement. With the exception of participant one and a transient deterioration by participant five, improvements were greater than that projected by baseline data. Due to the IES-6 and HADS-4 being collected concurrently inferences of causality cannot be made, however, it can be concluded that improvements in traumatic, or general psychological distress, appear related to respective improvements in the other. Comparable treatment effect sizes were found.

In-session Process Measures

Relative to initial baseline all participants demonstrated a marked decrease on perceived arousal and vividness ratings of the targeted memory, although the ordering of changes is unclear. Average pre-scores for perceived arousal and vividness were 8 and 9 respectively and at the last recursive loop were 1 and 2.6 comparatively. The

number of recursive loops (RL) performed varied between participants, however, this does not appear to be correlated with the severity of scores; participant five and six had the same pre-scores, yet, they required three and one RLs respectively.

Table 7

Outcome measure scores at pre-intervention, 1-week, 1-month, and 2-months follow-up

	Pre-intervention	1-week follow-up	1-month follow-up	2-month follow-up
Participant 1				
IES-6	18	11 ^R	13 ^R	13 ^R
HADS-A	9	13	10	7
HADS-D	14	7 ^R	15	15
SF-12 PCS	26.67	-	25.47	22.66
SF-12 MCS	24.02	-	29.38	27.84
Participant 2				
IES-6	6	0 ^R	1 ^R	1 ^R
HADS-A	8	6	5	1 ^{R C}
HADS-D	8	2 ^{R C}	2 ^{R C}	0 ^{R C}
SF-12 PCS	36.52	-	39.27	35.37
SF-12 MCS	42.88	-	62.97 ^R	65.14 ^R
Participant 3				
IES-6	14	2 ^{R C}	2 ^{R C}	2 ^{R C}
HADS-A	14	3 ^{R C}	2 ^{R C}	1 ^{R C}
HADS-D	6	3	3	1 ^{R C}
SF-12 PCS	38.33	-	42.94	48.46 ^R
SF-12 MCS	25.4	-	60.3 ^{R C}	58.63 ^{R C}
Participant 4				
IES-6	14	2 ^{R C}	0 ^{R C}	1 ^{R C}
HADS-A	12	7 ^{R C}	7 ^{R C}	3 ^{R C}
HADS-D	9	6	3 ^{R C}	0 ^{R C}
SF-12 PCS	34.16	-	46.95 ^R	51.81 ^R
SF-12 MCS	38.4	-	57.57 ^R	55.59 ^R
Participant 5				
IES-6	18	0 ^{R C}	DNC	†3 ^{R C}
HADS-A	14	3 ^{R C}	DNC	6 ^{R C}
HADS-D	9	1 ^{R C}	DNC	1 ^{R C}
SF-12 PCS	31.08	-	DNC	46.66 ^R
SF-12 MCS	34.15	-	DNC	39.77
Participant 6				
IES-6	19	5 ^{R C}	2 ^{R C}	3 ^{R C}
HADS-A	16	4 ^{R C}	5 ^{R C}	4 ^{R C}
HADS-D	9	5	4 ^{R C}	1 ^{R C}
SF-12 PCS	32.89	-	17.78 ^{R C}	11.02 ^{R C}
SF-12 MCS	30.57	-	62.1 ^R	52.06 ^R

Note. IES-6: Impact of Events Scale-6, higher scores demonstrate clinical deterioration; HADS: Hospital Anxiety and Depression Scale calculated as respective anxiety and depression subscales, higher scores demonstrate clinical deterioration; SF-12: Short-form Health Survey calculated as respective physical component scale (PCS) and mental component scale (MCS), higher scores demonstrate clinical improvement; ^R = Reliable Change at $p < .05$; ^C = Clinically Significant Change (from clinical to non-clinical range); DNC: Did Not Complete; - : Not collected; †3 month follow-up for Participant 5 due to hospital admission during data collection.

Four participants showed reliable and clinically significant reductions for traumatic stress (IES-6) from pre-intervention to post-intervention (1-week follow-up), which was maintained or further improved at subsequent follow-ups.

The SF-12 and HADS were calculated within their respective aggregate summary measures as recommended by the literature (Stern, 2014; Ware et al., 1996). Apart from two participants, SF-12 scores failed to meet clinical significance due to many participants starting scores lying within the ‘normal range’. However, five participants demonstrated a reliable improvement on the Mental Component Scale (MCS) at one-month follow-up; for three participants this was accompanied by concurrent improvements on the Physical Component Scale (PCS). Participant’s one, three, and six showed marginal deterioration on MSC at two-month follow-up. Similarly, participants one, two, and six showed deterioration on the PCS, with participant six showing extreme responding due to a change in health status at the one- and two-month follow-up.

With the exception of one, participants demonstrated overall improvement on the HADS anxiety (HADS-A) and depression (HADS-D) subscales. Improvements were accumulative over the three follow-ups, with all five participants demonstrating both reliable and clinically significant change on the HADS-A at the final follow-up. Given traumatic stress is partly understood as problematic anxiety, parallel improvements here and on the IES-6 offer support for coherency of participant responses.

Heart rate variability⁴⁰

Relative to baseline levels, five participants showed a decrease of parasympathetic tone and an increase in sympathetic activity at the start of the treatment session, shown by decreasing R-MSSD and HF scores (see Table 8 and 9). Participant one’s unexpected increase in HRV variables may be a result of their disengagement from the therapeutic process which is considered further in the discussion.

⁴⁰ See extended paper section 3.1 for visual display of HRV data per participant and calculations of median rank change between pre/post HRV indices.

Table 8

Within-session HRV and HR data

	Int-A R-MSSD (ms)	Int-B R-MSSD (ms)	Change score	Int-A HF (ms ²)	Int-B HF (ms ²)	Change score	Int-A HR (bpm)	Int-B HR (bpm)	Change score
Participant 1	102.3	153	50.7	3598.07	6767.1	3169.03	62	53	-9
Participant 2	40.4	52	11.6	464.9	916.15	451.25	65	56	-9
Participant 3	31.1	57.1	26	604.21	1089.41	485.2	81	73	-8
Participant 4	16.8	18.4	1.6	255.88	158.13	-97.75	94	91	-3
Participant 5	11	21.7	10.7	78.15	220.38	142.23	91	79	-12
Participant 6	15.6	23.2	7.6	53.81	204	150.19	75	70	-5

Note. R-MSSD: Square root of the mean of the sum of the squares of differences between adjacent R-R intervals; HF: High Frequency; ms²: Milliseconds/squared; HR: Heart rate; bpm: Beats per minute; Int-A: Intervention-A (Beginning of BWRT session); Int-B: Intervention-B (End of BWRT session). Reduction in scores highlighted in bold.

Table 9

Pre- and Post-intervention data for HRV variables

	Pre R- MSSD (ms)	Post R- MSSD (ms)	Change score	Pre HF (ms ²)	Post HF (ms ²)	Change score
Participant 1	49.5	63	13.5	1177.99	1336.06	158.07
Participant 2	48.4	36.2	-12.2	726.42	390.14	-336.28
Participant 3	44.1	33.2	-10.9	1120.22	752.2	-368.02
Participant 4	33.1	86.4	53.3	612.63	2869.09	2256.46
Participant 5	19	52.6	33.6	192.9	638.5	445.6
Participant 6	27.8	85.6	57.8	101.53	1276.37	1174.84

Note. Pre: Pre-intervention; Post: Post-intervention (one-month follow-up); R-MSSD: square root of the mean of the sum of the squares of differences between adjacent R-R intervals; HF: High Frequency; ms²: Milliseconds/squared. Reduction in scores highlighted in bold.

For all participants both HRV indices had increased at the end of the session and this was concomitant with reductions in HR (see Table 8), yet, visual inspection of HR graphs did not show curvilinear patterns of dearousal that can be anticipated in exposure therapies (Thayer et al., 2000). HR remained variable throughout the session, only culminating to a reduced average HR at the end. Three participants showed a decrease in HRV from Intervention-B to post-intervention recordings taken at one-month follow-up; two participants reduced to levels lower than baseline on both R-MSSD and HF indices. Four participants demonstrated an increase in R-MSSD and HF measures from pre- to post-treatment (see Table 9). Recordings for participant one, three, and four are to be interpreted with caution due to the presence of cardiac conditions and/ or cardioactive medication which can influence HRV (Alvares, Quintana, Hickie, & Guastella, 2016; Kemp et al., 2010).

Qualitative data⁴¹

Interpersonal Process Recall.

Participants were able to discuss examples of their internal experiences during pre-selected audio recordings. Arguably, verbal accounts of participants could be considered epiphenomenological given BWRT is purported to operate on an unconscious level; however, participant's conscious experiences as a recipient of this therapy still yielded important information regarding the processes and phenomenological changes encountered. See Table 10 for participants cued recall responses.

Wait state.

Five participants commented on their heightened arousal level to holding and freezing their trauma memory, which is commensurate to reactivity in exposure-based therapies.

⁴¹ See extended paper section 3.2 for a summary of quantitative and qualitative results per participant.

Moment of now.

Three participants commented on the ease at generating their preferred response and accompanying feelings of relaxation. Notably this self-reported change in affect and physiology was within 1-2 minutes of the initial exposure to the memory.

Recursive looping.

All participants spoke of the concentration demands and challenge of switching between memories at increasing speed during this stage. Five participants commented on the therapist's speed and volume of talking, one participant found this momentarily distracting, another was met with transient amusement, however, only one shared thoughts of wishing the process had been slower.

Table 10

Cued recall data from six participants summarised by question

Question	Participant 1	Participant 2	Participant 3	Participant 4	Participant 5	Participant 6
Wait State						
Feelings experienced	<p>Cognitive: It just races all the time (mind), can I hold it there (memory), is she going to win again (perpetrator)</p> <p>Physiology: None reported</p> <p>Emotion: Useless/hopeless</p>	<p>Cognitive: Focused on memory, took concentration</p> <p>Physiology: Tears</p> <p>Emotion: Overwhelmed, not for long</p>	<p>Cognitive: Focused on memory, took a couple of times to freeze it</p> <p>Physiology: Breathing quickened, clammy feel</p> <p>Emotion: Trepidation, dread, being pulled back into that scenario</p>	<p>Cognitive: Easy to imagine everything frozen, helped by the therapist talking to me</p> <p>Physiology: Tears, restless, breathing more panicky than before</p> <p>Emotion: Felt like I was back there, upset, went away quickly</p>	<p>Cognitive: Intense memory so easy to visualise, took a lot of energy to freeze it</p> <p>Physiology: Eyes squirming and ringing my hands, heart rate increased</p> <p>Emotion: On edge anxiety couldn't go any higher</p>	<p>Cognitive: Surprised by increased volume of therapist voice, it was tricky, would have preferred more silence for initial visualisation</p> <p>Physiology: Tensed, heaving feeling, heart racing</p> <p>Emotions: Dread, felt like I was back there</p>
Feelings towards therapist	None reported	None reported	None reported	Easier to not have to blurt everything out to someone	None reported	I thought this is a bit weird as the volume went up, not a negative though

Question	Participant 1	Participant 2	Participant 3	Participant 4	Participant 5	Participant 6
Moment of Now						
Feelings experienced	<p>Cognitive: Difficult imagining a different response, shall I leave it (questioning motivation to continue)</p> <p>Physiology: Breathing got heavier (therapist observation)</p> <p>Emotion: Anxious (about maintaining concentration)</p>	<p>Cognitive: Thought of good memories, could see colours, pinks and yellows</p> <p>Physiology: Warmth spreading through body</p> <p>Emotion: Happier</p>	<p>Cognitive: It was so simple, I think I said ‘no I’m not doing it’ (preferred response)</p> <p>Physiology: More relaxed</p> <p>Emotion: Calm</p>	<p>Cognitive: I wasn’t thinking consciously what this picture was, It just came into my head (preferred response)</p> <p>Physiology: Warmth throughout body</p> <p>Emotion: All the worry had gone, safe</p>	<p>Cognitive: At the start she showed me a picture of neurons in your head, and I had that in my head</p> <p>Physiology: Unable to remember</p> <p>Emotion: Unable to remember</p> <p>*Some memory degradation</p>	<p>Cognitive: So quick, I was just hearing but not listening, when I just let go and went with it, I actually dealt with it better.</p> <p>Physiology: None reported</p> <p>Emotion: Some momentary anxiety of trying to keep up with what the therapist was saying (although the therapist advised not trying to keep up)</p>
Feelings towards therapist	Talked quickly	None reported	Felt completely at ease	Despite the speed, I didn’t feel like I was being rushed	None reported	Automatic relationship of trust, felt like she had me

Question	Participant 1	Participant 2	Participant 3	Participant 4	Participant 5	Participant 6
Recursive Looping						
Feelings experienced	<p>Cognitive: Too much, my mind couldn't keep up, I needed to process the other memory first (preferred response)</p> <p>Physiology: None reported</p> <p>Emotion: Lots of concentration, fatigued</p>	<p>Cognitive: Listening and going from one to the other, quite intense, struggled a little</p> <p>Physiology: None reported</p> <p>Emotion: None reported</p>	<p>Cognitive: Had to change an image to an emotion, as you can't lock onto memories that quick, it was like a race, allowed me to shield myself from those emotions (dread) and ingrain what I should have said</p> <p>Physiology: so much energy to try and concentrate on that</p> <p>Emotion: Slight confusion, end of loop, Elation, really quite happy</p>	<p>Cognitive: I was thinking of going back and then my mind was shooting forward to the image that I wanted, concentrating so hard I think my brain was just going with what the therapist was saying, trying to process everything, trauma memory feeling further away</p> <p>Physiology: Eyes were moving whilst shut</p> <p>Emotion: Calm</p>	<p>Cognitive: Difficult to snap from one scenario to the other, easier with each loop, at times it was almost like I was unconscious</p> <p>Physiology: Heart rate decreasing with each loop</p> <p>Emotion: More relaxed with each loop</p>	<p>Cognitive: I had partitioned them, I was looking to the left for one and the right to the other with my eyes closed, only way I was able to keep up, concentrating a lot</p> <p>Physiology: My head and my eyes were moving</p> <p>Emotion: Increasingly relaxed</p>

Question	Participant 1	Participant 2	Participant 3	Participant 4	Participant 5	Participant 6
Feelings towards therapist	Tried to ignore the fast talking, thought please slow down	Very good to talk that fast	Slight pressure to keep up, initial amusement at fast talking	It didn't worry me how she was talking	None reported	Surprised at how quickly she was speaking, tuned into that throughout even though I was concentrating

Change interview.

Overall, participants' reports appeared to be largely congruent with quantitative measures. Five participants reported finding BWRT helpful and considered the intervention responsible for change. No iatrogenic effects were reported and demand-characteristics regarding reported phenomenological changes within the session were denied. See Table 11 for participants change interview responses.

Table 11

Change interview data from six participants summarised by question

Question	Participant 1	Participant 2	Participant 3	Participant 4	Participant 5	Participant 6
Experience of BWRT	Very fast moving, requires a lot of concentration, hard work <i>Comparison to past therapy:</i> Hardly any talking	Very good, requires a lot of concentration, quick positive results <i>No past therapy</i>	Impressive, energy and concentration needed to focus, really quick change, hardly talk about trauma, simple <i>Comparison to past therapy:</i> Felt more in control	Really good, easy (ability to engage in visualisation), concentrating so hard, simple <i>Comparison to past therapy:</i> No pressure to talk, not an interrogation	Really, really good, needed concentration, a success <i>Comparison to past therapy:</i> Worked quickly, very different	Positive, nothing negative, required concentration, it worked <i>Comparison to past therapy:</i> Much quicker, volume and speed of therapists' voice, not going as deep (reliving experienced in CBT and EMDR), less talking

Question	Participant 1	Participant 2	Participant 3	Participant 4	Participant 5	Participant 6
Any changes	<p>Positive: Unsure, memory not as strong</p> <p>Negative: Stirred up other things</p>	<p>Positive: Memory creates less emotion, good response now</p> <p>Negative: None reported</p>	<p>Positive: Massive, 18 years of negativity replaced, calmer mind, less guarded, more energy, returned to gym, memory less vivid</p> <p>Negative: None reported.</p>	<p>Positive: No emotion there, mind less busy, calmer, improved relationships, accepted myself</p> <p>Negative: None reported.</p>	<p>Positive: Memory faded, lighter thought patterns, increased confidence, reduced anxiety, ME symptoms have disappeared</p> <p>Negative: Hospital admission</p>	<p>Positive: Memory causes no upset, rationale thinking, calmer dealing with things, feel fixed, happier relationship with son</p> <p>Negative: None reported.</p>
Attribution of change or no change	<p>Therapy: Some changes</p> <p>External: Stressful time since therapy, current unemployment</p>	<p>Therapy: Yes, the therapy</p> <p>External: None reported</p>	<p>Therapy: 100% the programme</p> <p>External: None reported</p>	<p>Therapy: Going through the therapy</p> <p>External: None reported</p>	<p>Therapy: It's like nothing I have had before</p> <p>External: Poor sleep, bullying at work, financial worries attributed to hospital admission.</p>	<p>Therapy: Got to be the treatment, reprogramming my brain</p> <p>External: None reported</p>

Question	Participant 1	Participant 2	Participant 3	Participant 4	Participant 5	Participant 6
Helpful aspects	Partly helpful, another perspective on how to deal with it	Change in a short space of time, changing the way I think about it (memory)	<p>Every bit is important, having something feasible to replace it (preferred response), not having to talk much about it (trauma)</p> <p>‡<i>Environmental cues:</i> No emotional response</p>	<p>Concentrating and picturing certain things during the session, being guided (therapist role), not over-thinking, didn't need to talk or answer questions, feelings went quickly</p> <p><i>Environmental cues:</i> No emotional response</p>	<p>Knowing I can cope with it (managing brief exposure to memory), felt better immediately, can't explain how it works, it just did</p> <p><i>Environmental cues:</i> No emotional response</p>	<p>Change to memory, more convenient due to only needing one session.</p> <p><i>Environmental cues:</i> No emotional response</p> <p><i>Comparison to EMDR:</i> 'EMDR is the softly, softly approach, whereas BWRT is like let's just get the job done, but in a respectful way'</p>
Unhelpful aspects	None reported	None reported	None reported	None reported	None reported	None reported

Question	Participant 1	Participant 2	Participant 3	Participant 4	Participant 5	Participant 6
Difficult parts	Recursive looping	Focusing on and freezing the memory due to difficult emotions triggered	Initially focusing on the memory, uncomfortable but needed, flip flop it (recursive loop)	Holding the memory, all the emotions came back, didn't stay with it too long	Recursive looping	The concentration needed and the surprise at the speed and volume of the therapist's voice, distracted me from what I was trying to focus on
Memory saliency	Less frequent or intense	No emotion, not so clear, fuzzy	Watered down, foggy, no emotion	No emotion attached, can't see their faces anymore, still frozen	No emotion attached, bright before now appears in the distance	Physical block when trying to access it, in a vault but has a glass window, details faded (sights, sounds, smells)
Demand characteristics	None reported	None reported	Initially when freezing memory, only seconds	None reported	None reported	Not from therapist, from myself at brief moments
Anything missing from treatment	None reported	None reported	None reported	None reported	None reported	None reported

Question	Participant 1	Participant 2	Participant 3	Participant 4	Participant 5	Participant 6
Suggestions for therapy/ research	None reported	None reported	PDF/ Audio link with brief explanation of therapy before session	None reported	None reported	Follow-up study for long-term effects, some pre- warning of the speed of therapist talking

Note. †Four participants provided recent examples of situations they had encountered which previously triggered unwanted thoughts and feelings associated with the target memory; however, following the therapy participants reported experiencing no adverse responses when encountering the same situations.

Discussion⁴²

This study investigated whether: (1) Level 1 BWRT was an effective treatment for non-complex trauma; (2) whether process measures changed in ways that were congruent with hypothesised change mechanisms; and (3) how participants experienced BWRT more broadly.

Effectiveness of BWRT for non-complex trauma

We hypothesised that upon treatment completion participants would experience a marked reduction in traumatic stress, which was arguably the case in all participants; however, only four demonstrated improvements that were clinically significant and surpassed baseline projections for trend and median. Nonetheless, the duplication of effects across participants satisfies replication criteria outlined in the literature (Kratzschwill et al., 2010) suggesting BWRT to be a clinically active intervention; this was, further substantiated by treatment effect sizes. Additionally, the lack of resurgence of traumatic stress symptoms measured at one- and two-month follow-ups offers support for the durability of improvements. Concurrent improvements were demonstrated on measures of general psychological stress and QoL, although on the latter measure (SF-12) some regressions in scores were noted; yet, for the MCS, participants did not return to baseline levels. As theorised HRV indices increased pre- and post-treatment offering further support for the resolution of posttrauma difficulties; with the exemption of two participants demonstrating a deterioration. In these cases, participants were either taking cardioactive medication or had low levels of traumatic stress at baseline, meaning significant change in HRV was unlikely despite any effects of the intervention.

Process measure change

Efforts to understand the possible treatment mechanism(s) contributing to the effectiveness of BWRT included within-session ratings of memory vividness and arousal. As predicted, both indices decreased markedly following the introduction of recursive loop(s), offering potential support for the WM account of dual taxation.

⁴² See extended paper section 4 for further discussion of study findings, limitations, and considerations of clinical implications and future research.

Numerous studies have shown memory recall and dual taxation to reduce vividness and emotionality but recall only to elicit no change (Kemps & Tiggemann, 2007; Maxfield, Melnyk, & Hayman, 2008; Gunter & Bodner, 2008). Though study findings cohere with the WM theory and extant research, we cannot unequivocally demonstrate that self-reported changes were due to WM mechanisms. Yet, comparable to EMDR findings (Oren & Solomon, 2012), BWRT may therapeutically exploit memory lability during recall and aid the reconsolidation of the memory in a less vivid form, with the less salient memory being retrieved during future recalls. This is partly substantiated by participant's qualitative reports, describing the quality of their memory recall as 'fuzzy', 'watered down', and 'faded'. This blurring effect was maintained at one-month follow-up and was upheld when challenged by environmental cues associated with the emotional memory, suggesting some stability of effects.

In BWRT, the therapists increasing volume and speed of talking seemingly constitutes a form of dual taxation which appears similar to the auditory shadowing (i.e., simple speech recording) employed by Gunter and Bodner (2008), which demonstrated equivalent reductions in emotionality and vividness of the target memory. Consequently, the type of distractor task used in EMDR has progressed beyond eye movements and bi-lateral stimulation; however, unlike dual taxation in EMDR which seemingly functions as distraction alone, in BWRT the therapist's script is instructional prompting the clients attentional switching between memories. Importantly, the repetition and pace of the therapist's guidance make this distinctly different to imagery rescripting in TF-CBT (Holmes, Arntz, & Smucker, 2007). Yet, if dual-task manipulation is responsible for reducing the saliency of the target memory, the speed and volume of the therapists talking when encouraging the client to visualise and strengthen their preferred response during the *moment of now* and *recursive looping*, seems paradoxical. This is also a criticism of EMDR, whereby the use of dual taxation during hedonistically positive associations is considered a counter-effective part of the protocol (van den Hout & Engelhard, 2012).

The WM heuristics suggest a dose-response relationship to dual taxation, finding too little and too much taxing both have little or no effect (Engelhard, van den Hout, & Smeets, 2011). Interestingly, participants are shown to preference tasks they perceive as less 'tiring' or 'distracting', yet, these tasks actually yield less improvement (van den

Hout et al., 2011). Consequently, participants descriptions of the BWRT process demanding both energy and concentration, and the difficulties experienced when attempting to focus on the therapist's speed talking, may actually signal the efficacy of the treatment protocol. Yet, individual differences in WM capacity may mean for some BWRT processes are too taxing, a seeming experience of participant one.

Is BWRT another exposure therapy?

A collective view shared by five participants when considering the helpful parts of BWRT was the limited exposure to their trauma memory, not being required to talk about their trauma, and the considerably short time before improvements were experienced.

Psycho-physiological correlates of exposure induced anxiety are vagal withdrawal and decreased parasympathetic activity (Scott & Weems, 2014) which were evidenced within current findings. This was followed by an overall rise in parasympathetic activity and decrease in HR at the end of treatment, indicative of arousal reduction which was coherent with reductions on self-reported arousal/emotionality ratings. Yet, visual inspection of HR graphs did not show a curvilinear pattern of dearousal as anticipated in imaginal exposure (Foa & Chambless, 1978; Thayer et al., 2000). The EMP (Foa & Kozak, 1986) states that habituation is a gradual process most successfully achieved through prolonged, continuous exposures (20-100 minutes). Superiority of long over short exposures has been empirically supported (Chaplin & Levine, 1981; Marshall, 1985), alongside the findings that physiological dearousal precedes cognitive, emotional, and behavioural changes (Rodgers & Silver, 2002) and distracted exposure results in greater fear retention (Rothbaum, et al., 2005). Given this, although findings demonstrated within-session habituation, BWRT processes appear the antithesis of the exposure paradigm, in particular the lack of 'traditional' within-session physiological habituation, the incomplete exposure and detached processing, and the brief intervention time (a single session, 20 to 55 minutes). Together, these practices should render BWRT slower, if not ineffective. Based on these preliminary findings, exposure and habituation processes as currently understood do not appear to be key contributors to the positive outcomes generated by BWRT. Moreover,

dearousal may be an indicator of successful memory processing, and not a treatment mechanism as assumed by the EPM.

High autonomic activity can persist despite significant reductions in subjective manifestations of anxiety (Barlow, 1988) and can be influenced by cognitive load (Kawachi, 1997). Given participants experienced BWRT as challenging it is somewhat unsurprising that arousal levels were largely maintained during this process. Yet overall, findings suggest that after BWRT the somatic load is decreased, reflecting by proxy, the increased capacity of participants for context appropriate emotional responding and regulation aligned with the polyvagal theory (Porges, 2007). Noteworthy, is participant one's unexpected increase in HRV at the start of treatment. From a phylogenetic perspective this would be considered an adaptive survivalist response to the onset of fearful stimuli, which corresponds with research showing individuals with high resting HRV to more readily avoid fearful stimuli (Bornas, Riera, Tortella-Feliu, & Llabres, 2012). Disengagement from the therapeutic process may offer an explanation for participant one's lack of sustained improvement, which is further substantiated by their qualitative comments demonstrating their struggle to 'keep up' with the BWRT process.

Experience of BWRT

The limited exposure to the trauma memory and immediacy of improvement experienced by participants was considered a helpful feature of BWRT and appeared to instil a sense of mastery for participants that they were able to cope with exposure to their trauma memory. BWRT may have offered participants an empowering opportunity of holding a diluted version of their trauma memory, which in turn led to a relatively rapid cognitive change regarding their ability to cope. Arguably, such a phenomenon is less likely to occur in traditional exposure where clients have to endure difficult exposure exercises lending possible reinforcement for their appraisal of their memories as intolerable (Gunter & Bodner, 2008; Foa, Huppert, & Cahill, 2006). Moreover, self-reported changes from participants included greater flexibility in their thinking, less preoccupation and reaction when encountering previously distressing triggers/memories, a calmer disposition and improved relationships. All such changes lend accumulative support to the polyvagal theory, demonstrating participants improved neuroception capabilities and subsequent use of social engagement systems (e.g., they

are less threat active). Overall, participant's reports endorse BWRT as an acceptable and tolerable intervention for non-complex trauma, where significant and seemingly sustainable change can be achieved in a single session. Yet notably, the limited follow-up period does prohibit any strong conclusions regarding the longer-term effects of BWRT.

Limitations and Future Research

While these results are promising, this study is not without limitations. Although reliability studies have demonstrated the stability of HRV indices within-session (Cipryan, 2016) and across a three to four-month period (Tarkiainen et al., 2005) several factors can influence HRV, for example, sleep quality (Stein & Pu, 2012), physical output (Hautala et al., 2010), and intrinsic biological variation (Chen, 2011). All these factors are a potential source for the measurement bias. Consequently, to increase the robustness of future physiological measurement, alternative autonomic measures can be used in conjunction with HRV, for example, electrodermal arousal which provides a noninvasive, sensitive and stable measure of sympathetic skin response (Wilson, Silver, Covi, & Foster, 1996) and habituation effects (Kucera, Goldenberg, & Kurca, 2004).

Moreover, single-session investigations limit what, and how, phenomenon can be studied. Although this is not a limitation with regards to the efficiency and utility of the therapy, it does pose challenges within the research arena when attempting to delineate the mechanisms of action. The potential underlying mechanism of dual taxation could further be investigated by the pre-assessment of participants WM capacity prior to therapy. For example, a positive correlation between greater WM abilities and greater improvement in psychological stress would lend support for the WM hypothesis being relevant to BWRT, given the complexity and duration (90-120s) of the dual task procedure. In addition, dismantling studies would be of benefit to extricate the precise roles of the differing stages of the treatment protocol and what these offer to treatment outcome. However, as with other therapies it is clear that many answers to the questions surrounding BWRT lie in the brain. To investigate the neurobiological aspects of treatment, psychotherapy and brain research need to be developing in parallel otherwise theoretical development of BWRT and other therapeutic approaches will be hampered (Oren & Solomon, 2012).

Clinical Implications

It is of course too soon to conclude that BWRT is an efficacious therapy for non-complex traumatic stress, most obviously the present findings require replication. In addition, the follow-up period in this study is not sufficient to claim that effects outlast those of other therapies. However, the potential for BWRT to offer alleviation of trauma symptomology in a single session is a welcomed prospect given the current climate of the NHS, whereby services are being encouraged to economise their treatment pathways. In addition, it can be tentatively argued that BWRT may be a better tolerated therapy when compared to traditional exposure therapies and subsequently may lead to greater retention and maintenance of treatment gains, though this is yet to be tested.

To conclude, this was an exploratory study offering the first controlled research of BWRT. The results demonstrated an overall improvement with both psychological tests and HRV measures. Despite the limitations identified, these initial case series findings offer support for the effectiveness of BWRT for non-complex trauma; a finding that was substantiated by participants qualitative reports. Future research recommendations include the use of additional physiological measurement, WM assessments and the use of dismantling studies to decompose the multi-components of this nascent therapy.

Word count: 7,734

References

- Alvares, G. A., Quintana, D. S., Hickie, I. B., & Guastella, A. J. (2016). Autonomic nervous system dysfunction in psychiatric disorders and the impact of psychotropic medications: a systematic review and meta-analysis. *Journal of Psychiatry & Neuroscience*, 41(2), 89-104. doi:10.1503/jpn.140217
- American Psychiatric Association. (1980). *Diagnostic and statistical manual of mental disorders* (3rd ed.). Washington, DC: Author.
- American Psychiatric Association. (2013). *Diagnostic and statistical manual of mental disorders* (5th ed.). Washington, DC: Author.
- Andrade, J., Kavanagh, D., & Baddeley, A. (1997). Eye-movements and visual imagery: A working memory approach to the treatment of post-traumatic stress disorder. *British Journal of Clinical Psychology*, 36(2), 209-223. doi:10.1111/j.2044-8260.1997.tb01408.x
- Appelhans, B. M., & Luecken, L. J. (2006). Heart rate variability as an index of regulated emotional responding. *Review of General Psychology*, 10(3), 229-240. doi: 10.1037/1089-2680.10.3.229
- Arnberg, F. K., Michel, P., & Johannesson, K. B. (2014). Properties of Swedish posttraumatic stress measures after a disaster. *Journal of Anxiety Disorders*, 28(4), 402-409. doi:10.1016/j.janxdis.2014.02.005

- Bae, H., Kim, D., & Park, Y. C. (2015). Dissociation predicts treatment response in eye movement desensitization and reprocessing (EMDR) for post-traumatic stress disorder. *Journal of Trauma & Dissociation*, 17(1), 112-130.
doi:10.1080/15299732.2015.1037039
- Barlow, D. H. (1988). *Anxiety and its disorders: The nature and treatment of anxiety and panic*. New York: The Guilford Press.
- Barlow, D. H., Nock, M. K., & Hersen, M. (2008). *Single Case Experimental Designs: Strategies for Studying Behavior Change* (3rd ed.). Boston, MA: Pearson.
- Beauchaine, T. P., Gatzke-Kopp, L., & Mead, H. K. (2007). Polyvagal Theory and Developmental Psychopathology: Emotion Dysregulation and Conduct Problems from Preschool to Adolescence. *Biological Psychology*, 74(2), 174-184. doi:10.1016/j.biopsycho.2005.08.008
- Benito, K. G., & Walther, M. (2015). Therapeutic Process During Exposure: Habituation Model. *Journal of Obsessive-Compulsive and Related Disorders*, 6, 147-157. doi:10.1016/j.jocrd.2015.01.006
- Billman, G. E. (2013). The LF/HF ratio does not accurately measure cardiac sympatho-vagal balance. *Frontiers in Physiology*, 4. doi:10.3389/fphys.2013.00026
- Bisson, J., Ehlers, A., Matthews, R., Pilling, S., Richards, D., & Turner, S. (2007). Psychological treatments for chronic post-traumatic stress disorder: Systematic review and meta-analysis. *British Journal of Psychiatry*, 190(2), 97-104.
doi:10.1192/bjp.bp.106.021402

- Bonanno, G. A., & Mancini, A. D. (2012). Beyond resilience and PTSD: Mapping the heterogeneity of responses to potential trauma. *Psychological trauma: Theory, Research, Practice, and Policy*, 4(1), 74-83. doi:10.1037/a0017829
- Bornas, X., Riera, D. A. A., Tortella-Feliu, M., & Llabres, J. (2012). Heart rate variability profiles and exposure therapy treatment outcome in flight phobia. *Applied Psychophysiology and Biofeedback*, 37(1), 53-62. doi:10.1007/s10484-011-9179-5
- Bradley, R., Greene, J., Russ, E., Dutra, L., & Westen, D. (2005). A Multidimensional Meta-Analysis of Psychotherapy for PTSD. *The American Journal of Psychiatry*, 162(2), 214-227. doi:10.1176/appi.ajp.162.2.214
- Brewin, C. R., & Holmes, E. A. (2003). Psychological theories of posttraumatic stress disorder. *Clinical Psychology Review*, 23(3), 339-376. doi:10.1016/S0272-7358(03)00033-3
- Broman-Fulks, J. J., Ruggiero, K. J., Green, B. A., Kilpatrick, D. G., Danielson, C. K., Resnick, H. S., & Saunders, B. E. (2006). Taxometric Investigation of PTSD: Data from two nationally representative samples. *Behavior Therapy*, 37(4), 364-380. doi:10.1016/j.beth.2006.02.006
- Brooks, S. J., & Stein, D. J. (2015). A systematic review of the neural bases of psychotherapy for anxiety and related disorders. *Dialogues in Clinical Neuroscience*, 17(3), 261-276. Retrieved from <http://www.dialogues-cns.org/wp-content/uploads/issues/17/DialoguesClinNeurosci-17-261.pdf>

- Chang, H., Chang, C., Tzeng, N., Kuo, T. B., Lu, R., & Huang, S. (2013). Decreased cardiac vagal control in drug-naïve patients with posttraumatic stress disorder. *Psychiatry Investigation*, 10(2), 121-130. doi:10.4306/pi.2013.10.2.121
- Chaplin, E. W., & Levine, B. A. (1981). The effects of total exposure duration and interrupted versus continuous exposure in flooding therapy. *Behaviour Therapy*, 12(3), 360-368. doi:10.1016/S0005-7894(81)80124-4
- Chen, H. Y. (2011). Circadian patterns of heart rate turbulence heart rate variability and their relationship. *Cardiology Research*, 2(3), 112-118. doi:10.4021/cr41w
- Cipryan, L. (2016). Within-Session Stability of Short-Term Heart Rate Variability Measurement. *Journal of Human Kinetics*, 50, 85-92. doi:10.1515/hukin-2015-0146
- Cohen, J. A., & Mannarino, A. P. (2015). Time-Focused Cognitive Behavioural Therapy for Traumatized Children and Families. *Child & Adolescent Psychiatric Clinics of North America*, 24(3), 557-570. doi:10.1016/j.chc.2015.02.005
- Copeland, W. E., Keeler, G., Angold, A., & Costello, E. J. (2007). Traumatic Events and Posttraumatic Stress in Childhood. *Archives of General Psychiatry*, 64(5), 577-584. doi:10.1001/archpsyc.64.5.577
- Craske, M. G. (1999). *Anxiety disorders: Psychological approaches to theory and treatment*. Boulder, CO: Westview.

Crawford, J. R., Henry, J. D., Crombie, C., & Taylor, E. P. (2001). Normative data for the HADS from a large non-clinical sample. *The British Journal of Clinical Psychology*, 40(4), 429-434. doi:10.1348/014466501163904

De Smedt, D., Clays, E., Annemans, L., Doyle, F., Kotseva, K., Pajak, A.,...De Bacquer, D. (2013). Health related quality of life in coronary patients and its association with their cardiovascular risk profile: results from the EUROASPIRE III survey. *International Journal of Cardiology*, 168(2), 898-903. doi:10.1016/j.ijcard.2012.10.053

Ehlers, A., & Clark, D. M. (2000). A cognitive model of posttraumatic stress disorder. *Behaviour Research and Therapy*, 38(4), 319-345. doi:10.1016/S0005-7967(99)00123-0

Elliott, R. (2002). Hermeneutic Single Case Efficacy Design. *Psychotherapy Research*, 12(1), 1-20. doi:10.1080/713869614

Elliott, R., Slatick, E., & Urman, M. (2001). Qualitative Change Process Research on Psychotherapy: Alternative Strategies. *Psychologische Beitrage*, 43(3), 69-111.

Engelhard, I. M., van den Hout, M. A., & Smeets, M. A. M. (2011). Taxing working memory reduced emotionality and vividness of images about the Queen's Day tragedy. *Journal of Behaviour Therapy and Experimental Psychiatry*, 42(1), 32-37. doi:10.1016/j.jbtep.2010.09.004

Fisher, W. W., Kelley, M. E., & Lomas, J. E. (2003). Visual aids and structured criteria for improving visual inspection and interpretation of single-case designs.

Journal of Applied Behavior Analysis, 36(3), 387-406.

doi:10.1901/jaba.2003.36-387

Foa, E. B., & Chambless, D. L. (1978). Habituation of subjective anxiety during flooding in imagery. *Behaviour Research and Therapy*, 16(6), 391-399.

doi:10.1016/0005-7967(78)90010-4

Foa, E. B., & Jaycox, L. H. (1999). Cognitive-behavioral theory and treatment of posttraumatic stress disorder. In D. Spiegel (Ed.), *Efficacy and cost-effectiveness of psychotherapy: Clinical Practice* (Vol. 45, pp. 23-61). Washington, DC: American Psychiatric Association.

Foa, E. B., & Kozak, M. J. (1986). Emotional processing of fear: Exposure to corrective information. *Psychological Bulletin*, 99(1), 20-35. doi:10.1037/0033-2909.99.1.20

Foa, E. B., Huppert, J. D., & Cahill, S. P. (2006). Emotional processing theory: An update. In B. O. Rothbaum (Ed.), *Pathological anxiety: Emotional processing in etiology and treatment* (pp. 3-24). New York: Guilford.

Foa, E. B., Steketee, G., & Rothbaum, B. O. (1989). Behavioral/cognitive conceptualizations of post-traumatic stress disorder. *Behavior Therapy*, 20(2), 155-176. doi:10.1016/S0005-7894(89)80067-X

- Franklin, C. L., Sheeran, T., & Zimmerman, M. (2002). Screening for trauma histories, posttraumatic stress disorders (PTSD) and subthreshold PTSD in psychiatric outpatients. *Psychological Assessment*, 14(4), 467-471.
doi:10.1037/10403590.14.4.467
- Fried, I., Mukamel, R., & Kreiman, G. (2011). Internally generated preactivation of single neurons in human medial frontal cortex predicts volition. *Neuron*, 69(3), 548-562. doi:10.1016/j.neuron.2010.11.045
- Friedman, B. H., & Thayer, J. F. (1999). Autonomic balance revisited: Panic anxiety and heart rate variability. *Journal of Psychosomatic Research*, 44(1):133–151.
doi:10.1016/S0022-3999(97)00202-X
- Frustaci, A., Lanza, G. A., Fernandez, I., di Giannantonio, M., & Pozzi, G. (2010). Changes in psychological symptoms and heart rate variability during EMDR treatment: A case series of subthreshold PTSD. *Journal of EMDR Practice & Research*, 4(1), 3-11. doi:10.1891/1933-3196.4.1.3
- Gamelin, F., Baquet, G., Berthoin, S., & Bosquet, L. (2008). Validity of the polar S810 to measure R-R intervals in children. *International Journal of Sports Medicine*, 29(2), 134-138. doi:10.1055/s-2007-964995
- Gaston, L. (2015). *Limitations of Trauma-Focused Therapies for Treating PTSD: A Perspective* (Unpublished doctoral dissertation). University of Montreal, Canada.

- Ginzburg, K., Ein-Dor, T., & Solomon, Z. (2010). Comorbidity of posttraumatic stress disorder, anxiety and depression: A 20-year longitudinal study of war veterans. *Journal of Affective Disorders*, 123(1-3), 249-257.
doi:10.1016/j.jad.2009.08.006
- Giorgi, G., Perez, F. S. F., D'Antonio, A. C., Mucci, N., Ferrero, C., Cupelli, V., & Arcangeli, G. (2015). Psychometric properties of the Impact of Event Scale-6 in a sample of victims of bank robbery. *Psychology Research and Behaviour Management*, 8, 99-104. doi:10.2147/prbm.s73901
- Gold, S. D., Marx, B. P., Soler-Baillo, J. M., & Sloan, D. M. (2005). Is life stress more traumatic than traumatic stress? *Journal of Anxiety Disorders*, 19(6), 687-98.
doi:10.1016/j.janxdis.2004.06.002
- González-Prendes, A. A., & Resko, S. M. (2012). Cognitive-Behavioral Theory. In S. Ringel., & J. R. Brandell (Eds.), *Trauma: Contemporary Directions in Theory, Practice and Research* (pp. 14-40). Los Angeles, CA: Sage Publications.
- Guédon-Moreau, L., Ducrocq, F., Molenda, S., Duhem, S., Salleron, J., Chaudieu, I.,... Vaiva, G. (2012). Temporal analysis of heart rate variability as a predictor of post traumatic stress disorder in road traffic accidents survivors. *Journal of Psychiatric Research*, 46(6), 790-796. doi:10.1016/j.jpsychires.2012.02.006
- Gunter, R. W., & Bodner, G. E. (2008). How eye movements affect unpleasant memories: Support for a working-memory account. *Behaviour Research and Therapy*, 46(8), 913-931. doi:10.1016/j.brat.2008.04.006

- Harris, J. D. (1943). Habituated response decrement in the intact organism. *Psychological Bulletin*, 40(6), 385-422. doi:10.1037/h0053918
- Hautala, A. J., Karjalainen, J., Kiviniemi, A. M., Kinnunen, H., Mäkikallio, T. H., Huikuri, H. V., & Tulppo, M. P. (2010). Physical activity and heart rate variability measured simultaneously during waking hours. *American Journal of Physiology: Heart and Circulatory Physiology*, 298(3), 874-880. doi:10.1152/ajpheart.00856.2009
- Haynes, J. (2011). Decoding and predicting intentions. *Annals of the New York Academy of Sciences*, 1224(1), 9-21. doi:10.1111/j.1749-6632.2011.05994.x
- Haynes, J. D., Sakai, K., Rees, G., Gilbert, S., Frith, C., & Passingham, R. E. (2007). Reading hidden intentions in the human brain. *Current Biology*, 17(4), 323-328. doi:10.1016/j.cub.2006.11.072
- Holmes, E. A., Arntz, A., & Smucker, M. R. (2007). Imagery rescripting in cognitive behaviour therapy: images, treatment techniques and outcomes. *Journal of Behaviour Therapy and Experimental Psychiatry*, 38(4), 297-305. doi:10.1016/j.jbtep.2007.10.007
- Imel, Z. E., Laska, K., Jakupcak, M., & Simpson, T. L. (2013). Meta-analysis of dropout in treatments for posttraumatic stress disorder. *Journal of Consulting and Clinical Psychology*, 81(3), 394-404. doi:10.1037/a0031474

- Jacobson, N. S., & Truax, P. (1991). Clinical significance: A statistical approach to defining meaningful change in psychotherapy research. *Journal of Consulting and Clinical Psychology*, 59(1), 12-19. doi:10.1037/0022-006x.59.1.12
- Jaycox, L. H., Foa, E. B., & Morral, A. R. (1998). Influence of emotional engagement and habituation on exposure therapy for PTSD. *Journal of Consulting Clinical Psychology*, 66(1), 185-192. doi:10.1037/0022-006X.66.1.185
- Kawachi, I. (1997). *Allostatic Load Notebook: Heart Rate Variability*. Retrieved from <http://www.macses.ucsf.edu/research/allostatic/heartrate.php>
- Kazdin, A. E. (1981). Drawing valid inferences from case studies. *Journal of Consulting and Clinical Psychology*, 49(2), 183-192. doi:10.1037//0022-006X.49.2.183
- Keane, T. M. (1995). The role of exposure therapy in the psychological treatment of PTSD. *National Centre for PTSD: Clinical Quarterly*, 5(4), 1-6.
- Kemp, A. H., Quintana, D. S., Felmingham, K. L., Matthews, S., & Jelinek, H. F. (2012). Depression, comorbid anxiety disorders, and heart rate variability in physically healthy, unmedicated patients: Implications for cardiovascular risk. *PLoS ONE*, 7(2), 1-8. doi:10.1371/journal.pone.0030777
- Kemp, A. H., Quintana, D. S., Gray, M. A., Felmingham, K. L., Brown, K., & Gatt, J. M. (2010). Impact of depression and antidepressant treatment on heart rate variability: a review and meta-analysis. *Biological Psychiatry*, 67(11), 1067-1074. doi:10.1016/j.biopsych.2009.12.012

- Kemps, E., & Tiggemann, M. (2007). Reducing the vividness and emotional impact of distressing autobiographical memories: The importance of modality-specific interference. *Memory, 15*(4), 412–422. doi:10.1080/09658210701262017
- Kratochwill, T. R., Hitchcock, J., Horner, R. H., Levin, J. R., Odom, S. L., Rindskopf, D. M., & Shadish, W. R. (2010). *Single-case designs technical documentation*. Retrieved from https://www.ies.ed.gov/ncee/wwc/Docs/ReferenceResources/wwc_scd.pdf
- Kucera, P., Goldenberg, Z., & Kurca, E. (2004). Sympathetic skin response: review of the method and its clinical use. *Bratislava Medical Journal, 105*(3), 108-116.
- Laborde, A., Mosley, E., Thayer, J. F. (2017). Heart Rate Variability and Cardiac Vagal Tone in Psychophysiological Research – Recommendations for Experiment Planning, Data Analysis, and Data Reporting. *Frontiers in Psychology, 213*(8), 1-18. doi:10.3389/fpsyg.2017.00213
- Lane, J. D., & Gast, D. L. (2014). Visual analysis in single case experimental design studies: brief review and guidelines. *Neuropsychological Rehabilitation, 24*(3-4), 445-463. doi:10.1080/09602011.2013.815636
- Lee, E. A. D., & Theus, S. A. (2012). Lower heart rate variability associated with military sexual trauma rape and posttraumatic stress disorder. *Biological Research for Nursing, 14*(4), 412-418. doi:10.1177/1099800412454453

- Libet, B. (1985). Unconscious Cerebral Initiative and the Role of Conscious will in voluntary action. *Behavioral and Brain Sciences*, 8(4), 529-566.
doi:10.1017/s0140525x00044903
- Ma, H. H. (2006). An alternative method for quantitative synthesis of single-subject researches: Percentage of data points exceeding the median. *Behavior Modification*, 30(5), 598-617. doi:10.1177/0145445504272974
- Marriott, M., & Kellett, S. (2009). Evaluating a cognitive analytic therapy service; practice-based outcomes and comparisons with person-centred and cognitive behavioural therapy. *Psychology & Psychotherapy: Theory, Research and Practice*, 82(1), 57-72. doi:10.1348/147608308x336100
- Marshall, W. L. (1985). The effects of variable exposure in flooding therapy. *Behavior Therapy*, 16(2), 117-135. doi:10.1016/s0005-7894(85)80040-x
- Maxfield, L., Melnyk, W. T., & Hayman, G. C. A. (2008). A working memory explanation for the effects of eye movements in EMDR. *Journal of EMDR Practice and Research*, 2(4), 247–261. doi:10.1891/1933-3196.2.4.247
- McCraty, R., & Shaffer, F. (2015). Heart Rate Variability: New Perspectives on Physiological Mechanisms, Assessment of Self-regulatory Capacity, and Health Risk. *Global Advances in Health and Medicine*, 4(1), 46-61.
doi:10.7453/gahmj.2014.07

- McHorney, C. A., Kosinski, M., & Ware, J. E. (1994). Comparisons of the costs and quality of norms for the SF-36 health survey collected by mail versus telephone interview: results from a national survey. *Medical Care*, 32(6), 551-567.
doi:10.1097/00005650-199406000-00002
- Meadows, E. A., & Foa, E. B. (1998). Intrusion, arousal, and avoidance: Sexual trauma survivors. In V. M. Follette, J. I. Ruzek, & F. R. Abueg (Eds.), *Cognitive-behavioural therapies for trauma* (pp.100-123). New York: Guildford.
- Mowrer, O. H. (1956). Two-factor learning theory reconsidered, with special reference to secondary reinforcement and the concept of habit. *Psychological Review*, 63, 114–128. doi:10.1037/h0040613
- Mowrer, O. H. (1960). *Learning theory and the symbolic processes*. New York: Wiley.
- Naghavi, S. H. R., Shabestari, O., & Alcolado, J. (2013). Post-traumatic stress disorder in trainee doctors with previous needlestick injuries. *Occupational Medicine*, 63(4), 260-265. doi:10.1093/occmed/kqt027
- Najavits, L. M. (2015). The problem of dropout from ‘gold standard’ PTSD therapies. *F1000 Prime Reports*, 43(7), 1-8. doi:10.12703/p7-43
- National Institute of Clinical Excellence. (2005). *Post-traumatic stress disorder: management*. Retrieved from <https://www.nice.org.uk/guidance/CG26>

- Nishith, P., Duntley, S. P., Domitrovich, P. P., Uhles, M. L., Cook, B. J., & Stein, P. K. (2003). Effect of cognitive behavioral therapy on heart rate variability during REM sleep in female rape victims with PTSD. *Journal of Traumatic Stress, 16*(3), 247-250. doi:10.1023/a:1023791906879
- Nunan, D., Jakovljevic, D. G., Donovan, G., Singleton, L. D., Sandercock, G. R., & Brodie, D. A. (2010). Resting autonomic modulations and the heart rate response to exercise. *Clinical Autonomic Research, 20*(4), 213-221. doi:10.1007/s10286-010-0073-7
- Oren, E., & Solomon, R. (2012). EMDR therapy : An overview of its development and mechanisms of action. *European Review of Applied Psychology / Revue Européenne de Psychologie Appliquée, 62*(4), 197-203. doi:10.1016/j.erap.2012.08.005
- Pietrzak, R. H., Goldstein, R. B., Southwick, S. M., & Grant, B. F. (2011). Prevalence and axis I comorbidity of full and partial posttraumatic stress disorder in the United States: Results from wave 2 of the national epidemiologic survey on alcohol and related conditions. *Journal of Anxiety Disorders, 25*(3), 456-465. doi:10.1016/j.janxdis.2010.11.010
- Pilgrim, D. (2011). The hegemony of cognitive-behaviour therapy in modern mental health care. *Health Sociology Review, 20*(2), 120-132. doi:10.5172/hesr.2011.20.2.120

- Pineles, S. L., Mostoufi, S. M., Ready, C. B., Street, A. E., Griffin, M. G., & Resick, P. A. (2011). Trauma reactivity, avoidant coping, and PTSD symptoms: a moderating relationship? *Journal of Abnormal Psychology* 120(1), 240-206.
doi:10.1037/a0022123
- Porges, S. W. (1995). Orienting in a defensive world: Mammalian modifications of our evolutionary heritage. A polyvagal theory. *Psychophysiology*, 32(4), 301-318.
doi: 10.1111/j.1469-8986.1995.tb01213.x
- Porges, S. W. (2007). The polyvagal perspective. *Biological Psychology*, 74(2), 116-143. doi:10.1016/j.biopsycho.2006.06.009
- Porges, S. W. (2011). *The polyvagal theory: Neurophysiological foundations of emotions, attachment, communication, and self-regulation (Norton series on interpersonal neurobiology)*. New York: WW Norton & Company.
- Ray, D. C. (2014). Single-Case Research Design and Analysis: Counseling Applications. *Journal of Counseling & Development*, 93(4), 394-402.
doi:10.1002/jcad.12037
- Ritchie, J., & Spencer, L. (1994). Qualitative data analysis for applied policy research. In A. Bryman & R. G. Burgess (Eds.), *Analysing Qualitative Data* (pp. 172-194). London: Routledge.

- Rockcliff, H., Gilbert, P., McEwan, K., Lightman, S., & Glover, D. (2008). A pilot exploration of heart rate variability and salivary cortisol responses to compassion-focused imagery. *Journal of Clinical Neuropsychiatry*, 5(3), 132-139. doi:10.1037/t10178-000
- Rodgers, S., & Silver, S. M. (2002). Is EMDR an Exposure Therapy? A Review of Trauma Protocols. *Journal of Clinical Psychology*, 58(1), 43-59. doi:10.1002/jclp.1128
- Rothbaum, B. O., Astin, M. C., & Masteller, F. (2005). Prolonged exposure versus Eye Movement Desensitization and Reprocessing (EMDR) for PTSD rape victims. *Journal of Traumatic Stress*, 18(6), 607-616. doi:10.1002/jts.20069
- Ruscio, A. M., Ruscio, J., & Keane, T. M. (2002). The latent structure of posttraumatic stress disorder: A taxometric investigation of reactions to extreme stress. *Journal of Abnormal Psychology*, 111(2), 290-301. doi:10.1037/0021-843x.111.2.290
- Sandercock, G., Shelton, C., Bromley, P., & Brodie, D. (2004). Agreement between three commercially available instruments for measuring short-term heart rate variability. *Physiological Measurement*, 25(5), 1115-1124. doi:10.1088/0967-3334/25/5/003
- Schubert, S., & Lee, C. W. (2009). Adult PTSD and Its Treatment With EMDR: A Review of Controversies, Evidence, and Theoretical Knowledge. *Journal of EMDR Practice and Research*, 3(3), 117-132. doi:10.1891/1933-3196.3.3.117

- Scott, B. G., & Weems, C. F. (2014). Resting Vagal Tone and Vagal Response to Stress: Associations with Anxiety, Aggression and Perceived Anxiety Control among Youth. *Psychophysiology*, *51*(8), 718-727. doi:10.1111/psyp.12218
- Seidler, G. H., & Wagner, F. E. (2006). Comparing the efficacy of EMDR and trauma-focused cognitive-behavioral therapy in the treatment of PTSD: a meta-analytic study. *Psychological Medicine*, *36*(11), 1515-1522.
doi:10.1017/s0033291706007963
- Shaffer, F., McCraty, R., & Zerr, C. L. (2014). A healthy heart is not a metronome: an integrative review of the heart's anatomy and heart rate variability. *Frontiers in Psychology*, *1040*(5), 1-19. doi:10.3389/fpsyg.2014.01040
- Shapiro, F. (2014). The Role of Eye Movement Desensitization and Reprocessing (EMDR) Therapy in Medicine: Addressing the Psychological and Physical Symptoms Stemming from Adverse Life Experiences. *The Permanente Journal*, *18*(1), 71-77. doi:10.7812/TPP/13-098
- Shedler, J. (2010). The efficacy of Psychodynamic psychotherapy. *American Psychologist*, *65*(2), 98-109. doi:10.1037/a0018378
- Smith, J. D. (2012). Single-case experimental designs: A systematic review of published research and current standards. *Psychological Methods*, *17*(4), 510-550. doi:10.1037/a0029312

- Spinhoven, P., Ormel, J., Sloekers, P. P., Kempen, G. I., Speckens, A. E., & Van Hemert, A. M. (1997). A validation study of the Hospital Anxiety and Depression Scale (HADS) in different groups of Dutch subjects. *Psychological Medicine*, 27(2), 363-70. doi:10.1017/s0033291796004382
- Stein, M. B., Walker, J. R., Hazen, A. L., & Forde, D. R. (1997). Full and partial posttraumatic stress disorder: Findings from a community survey. *American Journal of Psychiatry*, 154(8), 1114-1119. doi:10.1176/ajp.154.8.1114
- Stein, P. K., & Pu, Y. (2012). Heart rate variability, sleep and sleep disorders. *Sleep Medicine Reviews*, 16(1), 47-66. doi:10.1016/j.smrv.2011.02.005
- Stern, A. F. (2014). Questionnaire Review: The Hospital Anxiety and Depression Scale. *Occupational Medicine*, 64, 393-394. doi:10.1093/occmed/kqu024
- Tan, G., Dao, T. K., Farmer, L., Sutherland, R. J., & Gevirtz, R. (2011). Heart rate variability (HRV) and posttraumatic stress disorder (PTSD): A pilot study. *Applied Psychophysiology & Biofeedback*, 36(1), 27-35. doi:10.1007/s10484-010-9141-y
- Tarkiainen, T. H., Timonen, K. L., Tittanen, P., Hartikainen, J. E., Pekkanen, J., Hoek, G.,... Vanninen, E. J. (2005). Stability over time of short-term heart rate variability. *Clinical Autonomic Research*, 15(6), 394-399. doi:10.1007/s10286-005-0302-7

Task Force of the European Society of Cardiology and the North American Society of Pacing and Electrophysiology (1996). Heart rate variability: standards of measurement, physiological interpretation and clinical use. *Circulation*, 93(5), 1043-1065. doi:10.1161/01.cir.93.5.1043

Taylor, S. (2002). Systematic desensitisation. In M. Hersen, & W. Sledge (Eds.), *Encyclopedia of Psychotherapy* (Vol. 2, pp. 755-759). New York: Elsevier Science.

Thayer, J. F., Friedman, B. H., Borkovec, T. D., Johnsen, B. H., & Molina, S. (2000). Phasic heart period reactions to cued threat and nonthreat stimuli in generalized anxiety disorder. *Psychophysiology*, 37(3), 361-368. doi:10.1111/1469-8986.3730361

Thompson, R. F., & Spencer, W. A. (1996). Habituation: A model phenomenon for the study of neuronal substrates of behaviour. *Psychological Bulletin*, 73(1), 16-43. doi:10.1037/h0022681

Thoresen, S., Tambs, K., Hussain, A., Heir, T., Johansen, V. A., & Bisson, J. I. (2010). Brief measure of posttraumatic stress reactions: Impact of Event Scale-6. *Social Psychiatry and Psychiatric Epidemiology*, 45(3), 405-412. doi:10.1007/s00127009-0073-x

Timulák, L., & Lietaer, G. (2001). Moments of empowerment: A qualitative analysis of positively experienced episodes in brief person-centred counselling. *Counselling & Psychotherapy Research*, 1(1), 62-73. doi:10.1080/14733140112331385268

- Tryon, W. W. (2005). Possible mechanisms for why desensitisation and exposure therapy work. *Clinical Psychology Review*, 25(1), 67-95.
doi:10.1016/j.cpr.2004.08.005
- van den Hout, M. A., & Engelhard, I. M. (2012). How does EMDR work? *Journal of Experimental Psychopathology*, 3(5), 724-738. doi:10.5127/jep.028212
- van den Hout, M. A., Engelhard, I. M., Rijkeboer, M. M., Koekebakker, J., Hornsveld, H., Leer, A.,...Akse, N. (2011). EMDR: Eye movement superior to beeps in taxing working memory and reducing vividness of recollections. *Behaviour Research and Therapy*, 49(2), 92-98. doi:10.1016/j.brat.2010.11.003
- van den Hout, M. A., Engelhard, I. M., Smeets, M. A. M., Hornsveld, H., Hoogeveen, E., De Heer, E.,...Rijkeboer, M. (2010). Counting During Recall: Taxing of Working Memory and Reduced Vividness and Emotionality of Negative Memories. *Applied Cognitive Psychology*, 24(3), 303-311. doi:10.1002/acp.1677
- van der Kolk, B. A., Spinazzola, J., Blaustein, M. E., Hopper, J. W., Hopper, E. K., Korn, D. L., & Simpson, W. B. (2007). A randomized clinical trial of eye movement desensitization and reprocessing (EMDR), fluoxetine, and pill placebo in the treatment of posttraumatic stress disorder: treatment effects and long-term maintenance. *Journal of Clinical Psychiatry*, 68(1), 37-46.
doi:10.4088/jcp.v68n0105

- Van Etten, M., & Taylor, S. (1998). Comparative efficacy of treatments for post-traumatic stress disorder: A meta-analysis. *Clinical Psychology and Psychotherapy*, 5(3), 126-144. doi: 10.1002/(sici)1099-0879(199809)5:3<126::aid-cpp153>3.0.co;2-h
- Van Hooff, M. V., McFarlane, A. C., Baur, J., Abraham, M., & Barnes, D. J. (2009). The stressor Criterion-A1 and PTSD: A matter of opinion? *Journal of Anxiety Disorders*, 23(1), 77-86. doi:10.1016/j.janxdis.2008.04.001
- Vannest, K., Davis, J., & Parker, R. (2013). *Single case research in schools: Practical guidelines for school-based professionals*. New York, NY: Routledge
- Villano, C. L., Rosenblum, A., Magura, S., Fong, C., Cleland, C., & Betzler, T. F. (2007). Prevalence and correlates of posttraumatic stress disorder and chronic severe pain in psychiatric outpatients. *Journal of Rehabilitation Research & Development*, 44(2), 167-178. doi:10.1682/jrrd.2006.05.0052
- Ware, J. E., Kosinski, M., & Keller, S. D. (1996). A 12-Item Short-Form Health Survey: construction of scales and preliminary tests of reliability and validity. *Medical Care*, 34(3), 220-33. doi:10.1097/00005650-199603000-00003
- Waters, J. (2017, August 22). New way to wipe out lifelong phobias - in just one session: How brain therapy targets flight or fight response helped conquer Alisa's fear of birds. *The Daily Mail*, p.51.

Watts, T. (2014). *BrainWorking Recursive Therapy, The Professional Training Manual Level 1*. Essex, United Kingdom: Unpublished. Permissions are available from the original author.

Weathers, F. W., Litz, B. T., Herman, D. S., Huska, J. A., & Keane, T. M. (1993). *The PTSD Checklist (PCL): Reliability, validity, and diagnostic utility*. Poster presented at the 9th Annual Conference of the ISTSS, San Antonio, TX.

Weippert, M., Kumar, M., Kreuzfeld, S., Arndt, D., Rieger, A., & Stoll, R. (2010). Comparison of three mobile devices for measuring R–R intervals and heart rate variability: Polar S810i, Suunto t6 and an ambulatory ECG system. *European Journal of Applied Physiology*, 109(4), 779-786. doi:10.1007/s00421-010-1415-9

Wilson, D., Silver, S., Covi, W., & Foster, S. (1996). Eye movement desensitisation and reprocessing: Effectiveness and autonomic correlates. *Journal of Behavior Therapy and Experimental Psychiatry*, 27(3), 219-229. doi:10.1016/s0005-7916(96)00026-2

Zigmond, A. S., & Snaith, R. P. (1983). The Hospital Anxiety and Depression Scale. *Acta Psychiatrica Scandinavica*, 67(6), 361-370. doi:10.1111/j.1600-0447.1983.tb09716.x

Zlotnick, C., Franklin, C. L., & Zimmerman, M. (2002). Does “subthreshold” posttraumatic stress disorder have any clinical relevance? *Comprehensive Psychiatry*, 43(6), 413-419. doi:10.1053/comp.2002.35900

Extended Paper

1. Extended Background

1.1 Trauma and PTSD

Achieving a consensus definition of trauma⁴³ among the field of traumatic stress has proven remarkably difficult given the dimensional nature of stressors (McNally, 2010). Variants include magnitude (e.g. threat of bodily integrity, interpersonal loss), complexity, duration, frequency, predictability and controllability (Weathers & Keane, 2007). The introduction of PTSD in the DSM-III (APA, 1980) offered the provision of a unifying construct, allowing researchers and clinicians to recognise commonalities in their work despite seemingly disparate referent traumas (Weathers & Keane, 2007). Symptoms following traumatic exposure are thought to include both psychological (e.g., intrusive recollection, re-experiencing, avoidance of trauma reminders, emotional numbing) and physiological (e.g., hyper-arousal, abnormal reactivity to cues, exaggerated startle response) alterations (APA, 2013).

PTSD is the only diagnostic category in the DSM that is based on aetiology (Schubert & Lee, 2009), to qualify for diagnosis an individual is required to have experienced a criterion A1 trauma. A criterion A1 trauma is an event considered outside the perimeter of usual human experience, with the likelihood of causing distress in almost anyone. Arguably this definition suggests events can only be traumatic because they are statistically rare (Weathers & Keane, 2007) which is oppositional to many studies that have shown people to display PTSD-like symptoms after exposure to stressors that fail to meet the DSM definition of trauma (Frustaci, Lanza, Fernandez, di Giannantonio, & Pozzi, 2010; Mol et al., 2005). The DSM further dichotomises trauma as single-event or complex trauma. Complex trauma is considered repetitive or prolonged in nature and is most often associated with interpersonal victimisation, through harm exploitation, and maltreatment including neglect, abandonment and antipathy (APA, 2013). The impacts are cumulative, for example; individuals may experience difficulties forming attachments, maintaining interpersonal boundaries, and develop a non-unified sense of self (Sanderson, 2006). Single-event trauma can also be

⁴³ Within this paper the term trauma and traumatic stress are used interchangeably, and both acknowledge the dimensional continuum of PTSD, including the range of trauma presentations from subthreshold, to full PTSD.

a form of interpersonal victimisation such as rape or assault, however, this is understood as being isolated to a single incident. Consequently, individuals may not experience the same extent of post-trauma pathology that accompanies complex trauma, and are more likely to experience spontaneous remission of PTSD (Kolassa et al., 2010).

Conversely, EMDR literature acknowledges general life experiences as a source of trauma that can have a lasting negative impact on the mind and refers to these as ‘small t traumas’ (Shapiro, 2014). However, critics suggest broadening the concept of trauma invites confusion regarding the causal significance of the stressor itself, and places greater emphasis on vulnerability factors in the aetiology of PTSD (McNally, 2010), including the risk of over-medicalising normal emotional responses to stressors (Shepherd, 2004). Additionally, criterion language suggests a traumatic event would typically involve an individual experiencing, witnessing, or being confronted with a threat to life or bodily integrity, including an elicitation of feelings of helplessness and terror (Herman, 1992). However, in line with many cognitive theories of PTSD (Brewin & Holmes, 2003; Ehlers & Clark, 2000) an important contributor to symptomatology beyond any effect of the objective trauma, is the individual’s subjective experience and perception of the trauma itself (Rubin & Feeling, 2013). Hence the phrase ‘traumatic stress’ refers to the event as well as the experience of being traumatised (Eagle & Kaminer, 2015). Additionally, naming the possible range of reactions attached to PTSD is needlessly restrictive and negates the presence of other dominant emotions that may accompany trauma, such as guilt or rage (Rubin, Berntsen, & Bohni, 2008). Consequently, non-qualifying stressors that may be considered common place misfortunes such as bereavement, marital discord, and redundancy can lead to post-traumatic symptoms and personal impairment (Cvetek, 2008) and are, therefore, therapeutically very important.

1.2 Epidemiology of Trauma

Research suggests experiencing trauma is relatively common; however only a small proportion of trauma victims, between 5% and 10%, will experience PTSD (Schubert & Lee, 2009). The World Health Organisation (WHO; Kessler & Ustun, 2008) documented lifetime prevalence rates of PTSD in over 27 countries, as ranging from 0.3% (China) to 6.1% (New Zealand). A UK lifetime prevalence estimate from the

Adult Psychiatric Morbidity Study from 2007, suggested 3% of the population were at risk of developing PTSD (McManus, Meltzer, Brugha, Bebbington, & Jenkins, 2009). However, this is unlikely to be representative now, given much more of the population will be traumatised since this data was collected. In psychiatric populations, documented PTSD rates range from 29% to 43% (Mueser et al., 1998), and 48% to 66% (Floen & Elklit, 2007). However despite this, PTSD is often missed in mental health settings typically when accompanied by other clinical complaints (Mueser et al., 1998). A blind spot such as this has notable implications for recovery (McFarlane, Bookless, & Air, 2001), and could be subsumed as more frequent in those clients presenting with negative life events where traumatic stress symptomology is unlikely to be considered by treating clinicians. This is further compounded by the lack of a universal definition that clearly delineates between full⁴⁴ and subthreshold or partial PTSD (Zlotnick, Franklin, & Zimmerman, 2002), preventing the collection of sound prevalence data.

Although the dose-response effect implies the greater the stressor the greater the probability of someone developing PTSD (March, 1993), perhaps the capability of stressors to cause traumatic stress is an empirical matter, not a conceptual one. A number of comparison studies have demonstrated greater PTSD symptom severity and overall distress in those who have experienced a non-criterion A1 event (i.e. relationship breakdown or chronic illness), than those who have (Long et al., 2008; Mol et al., 2005; Van Hooff, McFarlane, Baur, Abraham, & Barnes, 2009). There is emerging literature around the concept of ‘partial’, ‘subclinical’ or ‘subthreshold’⁴⁵ PTSD (Mitchell, Mazzeo, Schlesinger, Brewerton, & Smith, 2012; Schnurr, 2014). The first large-scale, cross-national study to investigate prevalence and correlates of subthreshold PTSD, defined the subthreshold symptom profile as experiencing two or three of the PTSD DSM-5 criterion (McLaughlin, et al., 2015). Using this definition, McLaughlin et al. (2015) found comparable rates of subthreshold PTSD (3.6%) and threshold PTSD (3.0%) among community populations. Earlier studies have reported prevalence rates ranging from 6.6% and 27.6% (Breslau, Lucia, & Davis, 2004; Pietrzak, Goldstein,

⁴⁴ The term full PTSD refers to trauma symptomatology that meets the threshold for a PTSD diagnosis.

⁴⁵ The term subthreshold will be used hereafter but will reflect the interchangeability of terms applied in the wider literature.

Southwick, & Grant, 2011), yet, these large differences are likely to be influenced by the respective samples studied; with Breslau and colleagues (2004) using a sample from Detroit, USA and Pietrzak and colleagues (2011) basing their findings on a national sample. However, when defining subthreshold PTSD, previous studies have placed importance on meeting specific symptoms, most notably avoidance, re-experiencing, and hyperarousal (Stein, Walker, Hazen, & Forde, 1997; Yarvis & Schiess, 2008), leading to further variability in prevalence estimates (Jeon et al., 2007). This lack of consensus on the optimal definition of subthreshold PTSD offers support to the view of PTSD as a dimensional continuum rather than a categorical phenomenon (Broman-Fulks et al., 2006; Erickson, Hedges, Vaughn, & Bair, 2013). Nonetheless, concerns exist regarding possible overdiagnosis (McNally, 2003) and secondary gain (e.g., financial remuneration; Jones & Wessely, 2007) if subthreshold PTSD were to be included in future DSM editions. However, meta-analytic research suggests that in addition to the significant impairment caused by subthreshold symptoms, individuals experiencing subthreshold symptomatology are 11 times more likely to develop full PTSD (Smid, Mooren, van der Mast, Gersons, & Kleber, 2009). Consequently, further evaluation of more nuanced definitions is needed to aid recognition of subthreshold PTSD, and to ensure those presenting with such difficulties are not neglected and are given access to trauma-focused therapies (Cukor, Wyka, Jayasinghe, & Difede, 2010; Erickson et al., 2013).

1.2.1 Gender Differences.

⁴⁶The National Comorbidity Survey (Kessler, Sonnega, Bromet, Hughes, & Nelson, 1995) identified women as more likely to develop PTSD (ratio approximately 2:1) despite a higher incidence of trauma exposure in men. Some hypotheses suggest this difference may be attributable to the types of traumatic events the genders are subjected too (Breslau, 2002). Women are more commonly exposed to sexual trauma which is consistently associated with high rates of PTSD; compared to physical assault and combat which men more commonly encounter (Tolin & Foa, 2006). These findings are supported by more recent prevalence data showing rates of 8.6%/4.1% for PTSD and 8.6%/4.5% for subthreshold PTSD, for women/men respectively (Pietrzak et al.,

⁴⁶Extract taken from authors previous academic submission.

2011). Similarly, Christiansen and Hansen (2015) found 24.9% of Danish women versus 7.7% of Danish men had subthreshold PTSD. Yet despite this, to date little research has investigated the gender disparity for subthreshold PTSD and whether this is associated with trauma type.

1.2.2 Comorbidity.

High rates of comorbidity have been found in full, and subthreshold PTSD (Adshead, 2000; Pietrzak, et al., 2011). Full PTSD is commonly comorbid with depressive disorders, anxiety, and substance misuse (Breslau, 2002; Dadić-Hero, Torić, Ružić, Medved, & Graovac, 2009; Mayou, Bryant, & Ehlers, 2001), and comparatively subthreshold symptoms often co-occur with depression, suicidal ideation, generalised anxiety, and alcohol abuse (Kessler, Chiu, Demler, Merikangas, & Walters, 2005; Naylor et al., 2013; Pietrzak, et al., 2011). Among veterans, similar levels of elevated aggression have been found across full and subthreshold PTSD presentations (Jakupcak et al., 2007), including equivalent rates for physical health concerns (Fetzner, McMillan, & Asmundson, 2012).

In general populations, subthreshold PTSD has also been associated with more chronic and enduring mental health difficulties, for example, borderline, schizotypal and narcissistic personality disorders compared to trauma controls (Pietrzak, et al., 2011). However, with any comorbidity data it can be difficult to delineate what the primary difficulty is (Licanin & Redzic, 2002), which is no doubt further complicated by the definitional issues surrounding subthreshold PTSD. Notwithstanding the limitations, it is apparent that those with subthreshold levels of symptoms also report difficulties with alcohol dependency (Boscarino, Adams, & Galea, 2006) and absenteeism from the workplace (Breslau, et al., 2004), both of which have an economic cost to society (McCrone, Dhanasiri, Patel, Knapp, & Lawton-Smith, 2008).

1.3 Risk Factors

As previously discussed, post-traumatic stress is not an inevitable result of trauma exposure, and therefore, it is important to consider the risk factors that may lead to the development of post-trauma psychopathology. Such risk factors are often categorised as pre-trauma (e.g., demographics, psychiatric history), peri-trauma (e.g.,

trauma type and severity), and post-trauma factors (e.g., social support, cognitive appraisals (Sayed, Iacoviello, & Charney, 2015).

Although risk factors specific to subthreshold PTSD are less clear, current research suggests a cross-over of risk factors between the trauma presentations. For example, prior trauma exposure, psychiatric history (Sayed et al., 2015), type and frequency of trauma (Müller, et al., 2014), and inadequate social support, both pre- and posttrauma (Koenen, Stellman, Sommer, & Stellman, 2008; Pietrzak, et al., 2012), are all considered shared risk factors for full, and subthreshold PTSD. Moreover, meta-analytic studies have consistently named poor social support as a key risk factor for the development and maintenance of traumatic stress (Brewin, Andrews, & Valentine, 2000; Guay, Billette, & Marchand, 2006; Ozer, Best, Lipsey, & Weiss, 2003). Research has found greater perceptions of control and family support among veterans to be associated with more resilient outcomes (Hayes, Wilson, Gifford, Follette, & Strosahl, 1996), and conversely, a lack of secure relationships and generalised anxiety to lead to greater PTSD symptomatology and poorer social functioning (Tsai, Harpaz-Rotem, Pietrzak, & Southwick, 2012). Converging evidence suggests that negative social support has a greater influence on PTSD maintenance, compared to the role of positive interactions in mediating symptoms (Charuvastra & Cloitre, 2008).

Physiological markers, namely HRV (see section 'HRV') have been indicated as a potential PTSD vulnerability factor. Research has found those with PTSD to have a lower HRV at rest, than healthy controls (Cohen et al., 2000; Guédon-Moreau et al., 2012; Porges, 1997); however, this is interpreted within the caveats of methodological limitations and sample issues (including heterogeneity in trauma populations studied) within the research (Porges, 2007). Conversely, a recent twin study substantiated these results by showing low HRV to effect only the twin with PTSD, which later normalised with remission of PTSD symptoms (Shah, et al., 2013). Consequently, low HRV may reflect an at-risk state rather than a trait. A study measuring HRV before, and after combat deployment found a moderate association between diminished HRV before trauma exposure and the experience of traumatic stress symptomatology when returning from duty, when compared to other active-duty personnel who had a higher baseline HRV (Minassian et al., 2015). A further review suggested that low HRV reflects poor cognitive and inhibitory control of stress response systems, which may disrupt a normal

stress response and lead to the increased likelihood of PTSD after trauma exposure (Gillie & Thayer, 2014).

1.4 Trauma Models⁴⁷⁴⁸

1.4.1 Conditioning Model.

The conditioning/ behavioural model understands PTSD as a disorder of reactivity, characterised by a preoccupation with concerns of safety, and a pathological exaggeration of an adaptive response to avoid similar threats and risks in the future (Friedman et al., 2011). Largely this reflects the pathology of learning mechanisms which usually utilise past experience for improved adaptive capabilities (Jakovljević et al., 2012).

Mowrer's (1960) two-factor theory of avoidance remains one of the most influential theories of learning and has been used to understand both the procurement and maintenance of anxiety disorders, and as a basis for clinical interventions (e.g., exposure therapy; Eysenck & Rachman, 1965). Mowrer (1960) suggests that the initial phase of fear acquisition is achieved through classical conditioning, whereby neutral stimuli present at the traumatic event acquire fear-eliciting characteristics, and thereafter elicit a similar conditioned emotional response to the original trauma stimulus, including flash-backs, dissociation, and fear-driven avoidance (Mowrer, 1956; González-Prendes & Resko, 2012). The avoidance response is operantly reinforced by eliminating, or by escaping these now noxious stimuli, resulting in fear reduction. Importantly, environmental cues do not trigger the overt behaviour directly but rather through covert mediators, namely thoughts and emotions (Beck, 1967). Consequently, avoidance is not only conditioned by the environment, but also by people's imagination of emotional experience, where they learn to repress fear inducing images (Brewin & Holmes, 2003). Avoiding fear, means an avoidance of 'reality testing', which is considered the key explanation as to why traumatic responding is outstayed (Mowrer, 1956).

⁴⁷ Some extracts taken from the authors previous academic submissions.

⁴⁸ It is beyond the capability of this paper to discuss and critique all extant trauma models, therefore, the models discussed are limited to those that underpin the two current frontline trauma treatments, TF-CBT and EMDR.

The two-factor theory offers a powerful explanation of many prominent features of PTSD, particularly the prevailing role of avoidance, the potential for trauma reminders, and the emotional and physiological responses evoked by these reminders (Brewin & Holmes, 2003; Davidson, Stein, Shalev, & Yehuda, 2004). Yet, the absence of cognitive constructs and the lack of recognition for non-fear emotions means the conditioning theory has a tendency to sound impoverished, and is therefore, often supplemented by other theories on cognition and emotion.

1.4.2 Cognitive Model.

Ehlers and Clark (2000) offered a cognitive model of PTSD which has taken up a prominent position in psychology literature and practice. They suggest that pathology begins with ineffective memory processing, whereby disturbing and traumatic events can overwhelm the brain's information-processing system leaving memories poorly elaborated, and inadequately integrated, into other autobiographical memories (Brewin & Holmes, 2003). In their unprocessed form memories remain as they were originally experienced, with the emotional, cognitive, and somatic content fundamentally unchanged. However, the persuasive psychological need to assimilate new and old information means the memories involuntarily break into consciousness through flashbacks or nightmares (Westbrook, Kennerley, & Kirk, 2011). Both the excessive arousal elicited, and the resulting dysfunctional and conflicting cognitive avoidance strategies employed to reduce distress, interfere with attention to and integration of disconfirmatory evidence (Massad & Hulsey, 2006). This is often further perpetuated by prevailing negative or critical appraisals and attributions, particularly of the self, commonly related to one's responses during the traumatic event (Ehlers & Clark, 2000). Here, it is the meaning the event has for the individual that is important, rather than the event itself (McNally, 2011), which allows acknowledgement of non-fear emotions common in PTSD such as guilt and shame.

From this perspective much of PTSD may be created by biases in thinking, given thoughts are important determinants of our actions (Jakovljević et al., 2012). This explanatory account of PTSD has led to the development of highly successful, and theoretically grounded treatment interventions (e.g., memory rescripting, cognitive

restructuring) which have received empirical backing (Brewin & Holmes, 2003; Ehlers & Clark, 2000; Hansen, Höfling, Kröner-Borowik, Stangier, & Steil, 2013).

1.4.3 Emotional Processing Model.

Foa and Kozak (1986) proffered an explanatory account of anxiety disorders that has received much support since it was first described (Bisson, 2009; Brewin & Holmes, 2003; Rodgers & Silver, 2002). Foa, Huppert, and Cahill (2006) argued that complex fear structures exist in the memory, and when activated, trigger cognitive, behavioural, and physiological responses. These responses are typically adaptive and help maintain an individual's safety (Bisson, 2009); however, they can also become pathological in certain situations, such as with PTSD. Here, memory structures can become fragmented and disorganised, particularly when an individual has experienced dissociative states at the time of the trauma (Brewin & Holmes, 2003; Halligan, Michael, Clark, & Ehlers, 2003). In addition, fear structures hold information regarding benign stimuli that have become associated with the trauma and subsequent danger, including the excessive physiological and behavioural reactions this triggers. Alongside information about stimuli and responses, fear structures are also thought to contain information about the meaning of traumatic events, for example, the probability of harm and an individual's ability to cope (Rodgers & Silver, 2002). However, importance is also placed on pre-trauma perceptions. Rigidity of pre-trauma beliefs, either negative (e.g., views of the self as extremely incompetent and the world as exceptionally dangerous) or positive (e.g., views of the self as very competent and the world as always safe) are considered to increase an individual's vulnerability to developing PTSD, due to such beliefs being either challenged, or confirmed by the traumatic experiences (Foa & Rothbaum, 1998; Dalgleish, 2004).

According to this model, improvement in therapy is related to changes in the memory structure, namely memories becoming more organised and coherent, in addition to, the correction of negative appraisals, allowing individuals to better discriminate between danger and safety (Foa & Rothbaum, 1998). Largely this is thought to be achieved through exposure and habituation processes (see section 1.5.1; Brewin & Holmes, 2003). While exposure therapies are an empirically supported treatment for PTSD (Foa, Ehlers, Clark, Tolin, & Orsillo, 1999), there has been less

consistent evidence supporting the theories predictions that clinical improvement is related to changes in memory structure, initial activation of fear, or habituation (Brewin & Holmes, 2003). For example, van Minnen, Wessel, Dijkstra, and Roelofs (2002) found improvement in PTSD symptoms posttreatment were correlated with a reduction in disorganised thoughts, yet not with changes in organised thoughts or narrative fragmentation. Similarly, Halligan et al. (2003) assessed for changes in memory disorganisation and trauma symptomology over a six-month period posttreatment, but struggled to find any significant associations between changes in memory disorganisation and changes in symptoms. This could reflect the measurement strategy, or a prevailing assumption that trauma memories remain unchanged despite the incorporation of new information and are instead inhibited by the formation of new memories created through extinction-based exposure (Brewin, 2006; McCleery & Harvey, 2004). Moreover, some research has found fear reduction to occur between treatment sessions, not within sessions (Jaycox, Foa, & Morral, 1998; van Minnen & Hageraars, 2002), which gives rise to the possibility of other mechanisms such as reappraisal, as opposed to habituation processes suggested by Foa and colleagues.

1.4.4 Polyvagal Theory.

The polyvagal theory (Porges, 1995, 1997, 1998) provides an alternative theoretical platform to understand trauma and other stress-related responses within the context of neural regulation. This theory has extended from evolutionary perspectives on trauma responses, which suggest for individuals with PTSD, the fear network (e.g., fight or flight) is continuously activated, leading them to navigate everyday life in whichever survival mode was adaptive during their traumatic experience (Chemtob, Roitblat, Hamada, Carlson, & Twentyman, 1988). This accounts for the high levels of arousal and increased sympathetic activity (Murburg, 1997) that differentiates PTSD from specific phobias. Porges (1995) describes how this evolved Autonomic Nervous System (ANS) influences our interactions with the environment.

Comparative research across vertebrate classes have identified three phylogenetically-ordered neural circuits associated with distinct autonomic subsystems expressed in mammals (Porges, 1997, 1998). Each subsystem supports a different category of behaviour, namely communication (myelinated vagus, ventral vagal

complex; VVC), mobilisation (sympathetic nervous system; SNS) and immobilisation (unmyelinated vagus; Porges, 2003). See Table 12 for further details.

Table 12

Polyvagal theory: The three phylogenetic stages and constituent responses

Phylogenetic stage	ANS component	Behavioural Function
III	Myelinated ventral vagal complex (VVC)	Social engagement; facial expressions and communication.
II	Sympathetic nervous system (SNS)	Mobilisation; fight-flight behaviours.
I	Unmyelinated dorsal vagal complex (DVC)	Immobilisation; feigning death and behavioural shut down.

Note. The phylogenetic order reflects the hierarchical response strategy in mammals. The most recent modifications (stage III) are employed first, and the most primitive last (stage I).

Appraisals of danger that initiate fight and flight responding lead to vagal withdrawal, this increases cardiac output by the SNS, disrupting visceral homeostasis and allowing for the mobilisation of defence mechanisms (Porges, 2011). The ‘freeze’ or immobilisation response is considered the most primal strategy; often unhelpful (e.g. fainting), it is accessed frugally and only when social engagement and mobilisation strategies respectively have failed (Porges, 2004). However, this latter response can be adaptive during a traumatic event, as this is the body’s form of dissociation, allowing the experience of pain to be reduced (Porges, 2004).

The theory suggests that invalid neuroception⁴⁹ of safety or danger contributes to the predominance of visceral states that are characteristic of several psychiatric profiles including trauma (Porges, 2007), with such individuals being more likely to function from the two phylogenetically older neural systems, making them less capable of social engagement behaviour even when this is considered adaptive (Sahar, Shalev,

⁴⁹ Neuroception is understood as the autonomic nervous system's continuous assessment of the relative safety or danger of any given moment or situation.

& Porges, 2001). Consistent with this supposition, inhibited vagal tone has been found among the following populations: antisocial and parasuicidal children and adolescents (Beauchaine, Katkin, Strassberg, & Snarr, 2001; Crowell et al., 2005), depressed, anxious, and panic disordered groups (Lyonfields, Borkovec, & Thayer, 1995; Rottenberg, Wilhelm, Gross, & Gotlib, 2003), trait hostile adults (Sloan et al., 1994) and adults with a borderline personality diagnosis (Austin, Riniolo, & Porges, 2007). It is well recognised that cardiac vagal tone signifies individual differences in emotional regulation capabilities (Beauchaine, 2001; Beauchaine, Gatzke-Kopp, & Mead, 2007). Moreover, research suggests extended periods of adopting such primitive defence mechanisms can also compromise one's physical health (Dennis, et al., 2016), and has been linked to inflammation (Dennis, et al., 2016; O'Donovan, Neylan, Metzler, & Cohen, 2012) and increased cardiovascular risk (Hayano, et al., 1990).

Conversely, high vagal tone is posited as an index of "flexibility" (El-Sheikh, Harger, & Whitson, 2001), and is associated with individuals using distress management strategies, for example, help-seeking and positive self-talk to manage difficulties (Geisler, Kubiak, Siewert, & Weber, 2013). This validates previous findings that demonstrated positive relationships between vagal tone and perceptions of social support (Schwerdtfeger & Schlagert, 2011).

1.4.4.1 Heartrate Variability.

High vagal tone is correlated with higher Heartrate Variability (HRV; Stein, Bosner, Kleiger, & Conger, 1994), indicating dominance of the parasympathetic response. HRV has been traditionally utilised in studies investigating cardiovascular risk (Kemp, Quintana, Felmingham, Matthews, & Jelinek, 2012); yet, has become increasingly used as an index of psychological processes (e.g., stress, attention, mental effort; Porges, 2007), particularly when such processes are difficult to infer from observable behaviour. HRV shows apparent vagal shifts (Elofsson, von Scheele, Theorell, & Söndergaard, 2008; Sack, Hofmann, Wizelman, & Lempa, 2008; Wilson, Silver, Covi, & Foster, 1996) and may have value in predicting therapeutic response to treatment (Beauchaine et al., 2007; Kemp et al., 2012; Nishith et al., 2003). Measurement of HRV relates to the ventral vagal complex, which directs parts of the body employed during interpersonal interactions (i.e., facial muscles and heart).

As abovementioned (see Risk Factors section), some studies have proposed perturbations in ANS regulation may influence an individual's vulnerability to developing PTSD following a traumatic event (Minassian, et al., 2015; Shaikh al arab, et al., 2012). Such research is in its infancy (Chang, et al., 2013); however, this association would make intuitive sense given sympathetic over-activity and/or parasympathetic insufficiency is seemingly correlated with poor coping (Geisler et al., 2013).

1.4.5 Adaptive Information Processing.

The underpinning theory of EMDR is the Adaptive Information Processing (AIP) model (Shapiro, 1995), which demonstrates some conceptual cross-over with the emotional processing model (Foa & Kozak, 1986). The AIP model assumes that, except for symptoms caused by organic deficit, the originator of psychopathology is inadequately processed memories of earlier traumata that have been stored in isolation with all the attendant state-specific characteristics, and which are repeatedly activated by environmental cues (Shapiro, 2014). It is thought EMDR allows the brain to access the stored experience and expedite the information processing system (Logie, 2014). However, unlike the emotional processing model which considers corrective information as coming from the therapeutic environment and habituation processes (Rothbaum, Astin, & Marsteller, 2005), the AIP model suggests corrective information is also incorporated from the clients focus on auxiliary life events/ memories during the reprocessing (Lee, Taylor, & Drummond, 2006). The assumption is that auxiliary material is often related to the targeted material in the client's memory network, and the encouragement of 'free association' to the trauma material in EMDR is thought to facilitate the integration of the target memory within the wider memory networks (Shapiro, 1995). In addition, the AIP model does not view change in cognitive appraisal as a key determinant, but rather considers this a by-product of successful processing by the internal association process (Solomon & Shapiro, 2008). The mechanism(s) of action in EMDR remain unclear, however, current evidence suggests this is achieved through assimilation and reconsolidation, rather than habituation (Rodgers & Silver, 2002). Recent neurobiological research has demonstrated via electroencephalography the cortical activation changes occurring during EMDR therapy. Results show firing in the prefrontal regions with limbic valence during initial trauma exposure, followed by

firing in prefrontal regions with more cognitive valence during and after processing, followed by an overall reduction of cortical hyperactivation in prefrontal regions at the end of the session (Pagani et al., 2012, 2015). Given these regions are implicated in fear processing (Hirata et al., 2007), the prefrontal cortex deactivation seen here likely represents the successful down-regulation of emotional experiences and encoding of unprocessed trauma material (Pagani et al., 2015). Comparable neurobiological findings have been found in CBT that have demonstrated reduced activation of the neural network of fear conditioning in panic disorder (Kircher et al., 2013). Although, the mechanisms to achieve such neurobiological changes are seemingly different as currently understood based on the literature reviewed. Within the EMDR community a number of underlying processes have been posited, however, the hypothesis with the most empirical support is the WM account of dual taxation (see Treatment Mechanisms section below; Logie, 2014; van den Hout et al., 2011a; van den Hout & Engelhard, 2012).

1.4.6 Brain Work Recursive Therapy.

1.4.6.1 Research of Benjamin Libet and successors.

Libet's (1985) early experiments found that the brain begins to prepare the motor areas to react notably early, during initial stimulus presentation, suggesting the brain initiates decisions to respond before we are consciously aware of what the response will be. Libet (1985) detected a gap of several hundred milliseconds between stimulus processing and response execution. However, Libet's timing judgements were unreliable given participants had to self-report when they consciously formed their intention to move creating possible distortions of true timing, in addition to results being based on averages and not statistical assessment (Haynes, 2011). Succeeding research by Haynes et al. (2007) and Fried, Mukamel, and Kreiman (2011) modernised Libet's experiments and offered further support for the time lag. Using Functional magnetic resonance imaging (fMRI) Haynes (2011) demonstrated a time lag of up to 4 seconds and Fried et al. (2011) detected a lag of a second and a half using single neuron recordings. Studying single neurons allowed the authors to predict the timing of a decision 700 milliseconds before conscious awareness, with 80% accuracy. Despite such promissory predictions, findings at present remain correlational and causal

connections between brain mechanisms and conscious intent remain unclear (Smith, 2011). This is partly due to consciousness itself being a fuzzy concept, creating intractable measurement issues (Collerton, 2013).

Further research utilising electrocorticography (ECoG) measurement has consistently shown stimulus-to-response neuronal activity in the prefrontal cortex, generated during initial stimulus processing and lasting until the response (Haller et al., 2017). The deliberation window before response selection occurs, appears to be partly influenced by response familiarity (Haller et al., 2017). However, when under stress the prefrontal cortex can become compromised, leaving the brain to degenerate from a 'reflective' to a 'reflexive' state and for neuronal pathways in lower emotional centers to become more active, leading to automated, primal reactions (Arnsten, Mazure, & Sinha, 2012). Such automated, survivalist responses and the corresponding neuronal pathways become problematic when they are no longer functional or context appropriate and are considered to contribute to mental health difficulties such as depression, addiction and anxiety disorders, including post-traumatic stress (Arnsten et al., 2012). It is these problematic neuronal pathways that form a target for intervention in BWRT, with BWRT purportedly exploiting the time lag between stimulus processing and response selection to install a preferred response (Watts, 2014).

1.4.6.2 Application of BWRT

Our understanding and responses we have to our environment are reflected through the patterned firing of familiar synaptic circuits (Damasio, 1994); with the exception of the 'loud noise' and 'falling' reflexes present at birth, these patterned circuits are both acquired and modified by experience. Reward and punishment contingencies can serve to strengthen and extinguish behavioural responses, which on a neurobiological level can be considered the entrenchment or degradation of corresponding neural pathways (Packard & Knowlton, 2002; Tryon, 2005). Libet's (1985) research suggested neural pathways can be up to 50 meters long, creating a time gap of approximately 1/3 of a second for incoming data from the environment to traverse through the neural networks and reach awareness in the outermost cortical region of the brain, where conscious thought occurs (Haller et al., 2017). Watts (2014) introduced the 'pattern recognition matrix' construct, which he considers responsible for

triggering learned behaviour when encountering familiar situations and for directing responses towards survival or pleasure. In addition, Watts (2014) considers anxiety to be elicited when the brain is unable to pattern match due to the novelty of a situation, and conscious thought is relied upon to identify a suitable response. However, typically the conscious cognitive appraisal of whether a response is helpful or unhelpful or appropriate or inappropriate, does not exist at the earliest stages of the neural pathway. Neuroscientists have tracked the brain's activity as it detects, interprets, selects a response, and activates motor neurons to respond, before participants are even aware of how they will respond (Haller et al., 2017). These somewhat automated responses are subject to revision when reaching conscious awareness; however, if this response has been repeatedly conditioned they can become resistant to change which creates problems when the response is no longer context appropriate. It is these problematic and entrenched neural pathways that are considered the basis of psychopathology in BWRT. BWRT is thought to work within the stimulus-to-response time gap, by intercepting the pattern matching process and installing a preferable response with a new supporting neural pathway (Watts, 2014). This is reportedly achieved through the repetitive recursive looping stage, and the rapidity of the therapist's speech which serves to block unwanted extraneous information. Whilst we can be certain learning entails synaptic change (i.e., brain plasticity; Donahoe & Palmer, 1994; Gluck, Meeter, & Myers, 2003; Kalat, 2001), Watts (2014) postulations of how BWRT works remain hypotheses, and notably hypotheses that are more challenging to test in non-laboratory settings.

1.5 Treatment Mechanisms⁵⁰

1.5.1 Exposure and Habituation.

Exposure therapy is understood as the “systematic and repeated confrontation with phobic stimuli” (Craske, 1999, p. 107), which is thought to work by means of habituation and/or extinction processes (Rodgers & Silver, 2002). Habituation and extinction refer to the same process of achieving a reduction in conditioned responses through repeated presentation to noxious stimuli; however, extinction achieves this

⁵⁰ It is beyond the scope of this paper to consider all researched treatment mechanisms implicated in trauma therapy, therefore, only the two mechanisms investigated in this study are discussed.

through the absence of reinforcement contingencies (Tryon, 2005). For this reason, habituation was originally considered a transient process with transient effects, described previously as a temporary 'autonomic dampening' (Foa, 1979, p. 173). However, extinction and habituation are now acknowledged as both having long-term decrements in conditioned stimuli (Thompson & Spencer, 1996), but are considered to require long exposure times (Rodgers & Silver, 2002), with sessions lasting up to 90 minutes to allow sufficient time for exposure alongside grounding practices, over a duration of 8-20 sessions (Grey, Young, & Holmes, 2002). Additionally, clients often receive tape recordings/written narratives of their exposure session with the encouragement to review this repeatedly between sessions. The trajectory of within-session habituation during exposure characteristically begins with an increase in anxiety, followed by a plateau and a steady decline in anxiety (Foa & Chambless, 1978; Thayer, Friedman, Borkovec, Johnsen, & Molina, 2000). Typically, imaginal exposure habituation demonstrates a more curvilinear pattern and in vivo exposure a more directly linear decrease (Foa & Chambless, 1978); this is somewhat expected given more time is required to fully experience and connect with a mental image, in comparison to an actual stimulus (Rodgers & Silver, 2002). Moreover, in line with the two-factor theory (Mowrer, 1956), clients are encouraged to remain in the exposure until anxiety levels have declined, as leaving prematurely while anxiety levels remain high could promote avoidant behaviour in future situations (Brewin & Holmes, 2003).

To achieve durable fear reduction in exposure therapy clients are encouraged to 'relive' their trauma and are guided to reflect on events in detail in the first person tense, as if it were happening now (Foa & Rothbaum, 1998; Lyons & Keane, 1989). This includes visual, auditory, physical, emotional and cognitive information attached to the traumatic experience. Repeated reliving is thought to create a more organised memory record that is easier to integrate within the wider memory network, whereas relatively brief, simplistic, and poorly articulated trauma narratives are considered inadequate to modify fragmented fear structures (Foa & McNally, 1996; Richards & Lovell, 1999). Similarly, treatment elements that distract or divide a client's focus away from the target trauma memory are seen as a form of avoidance rendering the exposure incomplete, and are therefore, actively discouraged by the therapist (Lee et al., 2006). The most potent corrective information is considered to come from the experience of fear habituation,

resulting in spontaneous cognitive change achieved by the reliving experience, either within or between sessions (Brewin & Holmes, 2003; Lee et al., 2006). Yet, this may be more applicable to cognitions about perceptions of danger, rather than negative self-evaluations associated with guilt and shame, which may require a conscious reappraisal of beliefs (Ehlers et al., 1998). Furthermore, the benefits of exposure may also derive from the sense of mastery and courage instilled in the client through this challenging process (Foa & Rothbaum, 1998).

Despite the large body of evidence regarding the efficacy of exposure techniques in trauma therapy (Cahill, Rothbaum, Resick, & Follette, 2009), the approach remains underutilised in clinical practice (Cook, Schnurr, & Foa, 2004). Becker, Zayfert, and Anderson (2004) found a large proportion (83%) of the 207 licensed psychologists surveyed to not use exposure-based therapies in their treatment of clients with PTSD, instead opting for non-trauma approaches. The reasons for this more broadly range from a lack of specialised training or experience using exposure (Becker et al., 2004), a perception that exposure is more distressing than other interventions and could potentially escalate symptoms (Deville & Huth, 2007; van Minnen, Hendriks, & Olff, 2010), and concerns regarding a higher likelihood of drop out (Ruscio & Holohan, 2006). Conversely, several studies have suggested clients are more receptive to exposure-based treatment than is currently depicted in the abovementioned usage rates. Studies have demonstrated greater preference for exposure compared to; medication (Angelo, Miller, Zoellner, & Feeny, 2008; Cochran, Pruitt, Fukuda, Zoellner, & Feeny, 2008); supportive therapy and EMDR (Becker, Darius, & Schaumburg, 2007); EMDR, psychodynamic psychotherapy, computer-based therapy and group therapy (Tarrier, Liversidge, & Gregg, 2006). Importantly, many of these study participants did not have a diagnosis of PTSD, had a history of trauma but did not develop PTSD, or were lay people (i.e. students) presented with hypothetical cases. Together this complicates the interpretation of the abovementioned results, leaving the treatment preference outcomes of clients with PTSD unclear (van Minnen, et al., 2010).

1.5.1.1 Brain Work Recursive Therapy.

Based on the functional definition of exposure and habituation BWRT is certainly consistent with this, as the therapy both encourages the client's attention to the

traumatic memory and utilises within-session arousal ratings to monitor subjective arousal changes towards the target memory, akin to habituation. However, classifying BWRT as an exposure therapy becomes somewhat paradoxical when the methodology of this heavily protocolised therapy is juxtaposed with the historical assumptions and practice of exposure therapies (Foa, Rothbaum, Riggs, & Murdock, 1991; Lyons & Keane, 1989), and with features of the EPM (Foa & Kozak, 1986; Foa & Rothbaum, 1998).

The emotional processing model conceptualises habituation as a gradual process and predicts better therapeutic outcomes with prolonged, continuous exposures (20–100 minutes; Foa & Kozak, 1986; Rodgers & Silver, 2002). Yet BWRT uses very brief (90–120s) exposures. The exposure is predominantly at the start of the session when the client is encouraged to focus on the most distressing scene, and towards the end of the protocol when the client is instructed to move their attention quickly backward and forward in time, through different memories including the targeted memory (Watts, 2014), in a seemingly saltatory fashion. Moreover, BWRT looks to encourage a detached form of processing, whereby the therapists encourage the clients to be an observer of their trauma memory, rather than being part of the trauma which is considered essential in the reliving experience (Richards & Lovell, 1999). Similarly, the client is encouraged to share very little of their trauma experience and remains a largely silent recipient throughout the process, with the therapist's instructions forming the main verbal content. The client's dual attention between their memories and the therapist's instruction which at scripted stages increases exponentially in volume and speed, appears to constitute a distractor task. According to the habituation model, interrupted attention to the trauma material should slow the rate of fear decrement; yet, anecdotally this does not appear to be the case with practice-based evidence showing notable clinical improvement after a single session (A. Abey, personal communication, June 22, 2017). Additionally, empirical support for this prediction is equivocal (Rodgers & Silver, 2002). Grayson, Foa, and Steketee (1982) reported distracted exposure to result in increased fear retention than focused exposure; yet, his later findings showed an equal fear retention between distracted and focused exposure, and greater within-session fear reduction with distracted exposure (Grayson et al., 1982). In contrast, Rodriguez and Craske (1993) found less within-session fear reduction with distracted

exposure, and Craske, Street, and Barlow (1989) found distracted exposure to yield short-term but not long-term improvement. The methodological differences in population (e.g., panic, phobia), exposure technique (e.g., imaginal vs. in vivo), and distractor tasks (e.g., motor tasks vs. cognitive tasks), limit the conclusions that can be drawn from this line of research. Conversely, more recent research generated by the EMDR community has shown empirical support for divided/ dual attention, considering this a key treatment mechanism of EMDR therapy (see section below). However, as currently understood it appears that BWRT and exposure-based therapies may arrive at similar outcomes, but through different therapeutic processes.

1.5.2 Dual Taxation of Working Memory.

The WM account of dual taxation has received the most empirical support in terms of providing an explanatory account for the effects of eye movements and other dual/ distractor tasks in EMDR therapy (van den Hout & Engelhard, 2012). The WM includes a central executive response for higher-order cognitive functions (e.g., planning, divided attention; Kane & Engle, 2002), two modality-specific subsystems, namely the visuospatial sketch pad where images are held in mind and the phonological loop which stores verbal and auditory information (Baddeley & Hitch, 1974), and lastly the episodic buffer which is a limited capacity storage system, affording the integration from both the subsystems with information from long-term memory when complex memories are recapitulated (Baddeley & Andrade, 2000). The central executive is considered to offer “an attentional capability whereby memory representations are maintained in a highly active state in the face of interference” (Kane & Engle, 2002, p. 637), which fittingly describes the dual taxation process in EMDR when a client is encouraged to hold a memory in mind whilst attending to a distractor task (e.g., eye movements). Gunter and Bodner (2008) found a robust negative correlation between the benefits of eye movements (i.e., reduced vividness and emotionality of target memory) and the scores on a measure of central executive capacity (i.e., reading span), offering evidence for the central executive’s role in complex forms of multi-tasking. Dual taxation during memory recall is considered to disrupt the storage and reconsolidation of the recalled memory, leading to a reduction in episodic quality (Lee et al., 2006). As a consequence, the memory should become less vivid and less emotional (Andrade,

Kavanagh, & Baddeley, 1997). This is not exclusive to traumatic memories; but should also apply for mildly negative memories with results supporting this (Lee & Cuijpers, 2013). Notably, emotional memories typically have an episodic form and are rich in sensory and contextual information (e.g., time, place, and associated emotions), with trauma recovery thought to occur when these memories forgo their sensory richness (Stickgold, 2002). A reduction in memory saliency is oppositional to the ‘imagination inflation’ effect which is a common phenomenon in police interrogation (Goff & Roedinger, 1998), whereby the encouragement of a witness/ suspect to vividly visualise an event repeatedly, influences the original memory, which becomes more vivid and realistic affecting future recollections. From a WM perspective, memory recall and a concurrent distractor task leads to ‘imagination deflation’, and this should similarly be evident in future recollections after the dual-task session (van den Hout & Engelhard, 2012; van Veen et al., 2015).

Experimental findings have largely supported predictions derived from the WM hypothesis, providing a theory-grounded explanation of the benefits of eye movement and other dual tasks. Non-clinical laboratory studies have shown clear processing effects of eye movements demonstrated by decreases in vividness and/or emotionality compared to control conditions such as, spatial tapping (Andrade et al., 1997), finger tapping (van den Hout, Muris, Salemink, & Kindt, 2001), and no eye movement (Barrowcliff, Gray, Freeman, & MacCulloch, 2004; Gunter & Bodner, 2008; Kavanagh, Freese, Andrade, & May, 2001). Importantly, for tasks that are experienced as easy or automatic the central executive is less likely to be involved even if this qualifies as divided attention (Quinn & McConnell, 1996), which may offer some explanation as to why some distractor tasks appear more effective than others. Similarly, if tasks are too taxing this does not allow for sufficient WM resources to enable active recall of material from long-term memory, therefore precluding any benefits (van den Hout & Engelhard, 2012). In addition, a relatively new implication of the WM hypothesis is that neither eye movements nor bilateral stimulation is needed, but any taxing task should reduce the vividness, and therefore, the emotional tone of the memory. This has been found with the following tasks; copying a complex figure (Gunter & Bodner, 2008); mental arithmetic (Engelhard, van den Hout, & Smeets, 2011; van den Hout et al., 2010); playing the computer game Tetris (Engelhard, van Uijen, & van den Hout, 2010a);

auditory shadowing (Gunter & Bodner, 2008); mindful breathing (van den Hout et al., 2011b); and calculating out loud (Kemps & Tiggemann, 2007). Compared to the 'recall only' which is essentially brief intervals of exposure, memories became less vivid and/or less emotional during all these tasks, offering support for the WM account with a central-executive locus. However, the majority of studies have either used analogue samples, or had a focus on non-specific distress or other anxiety disorders (i.e., panic disorder); with only four studies included in a meta-analysis on the benefits of eye movements having a focus on PTSD (Lee & Cuijpers, 2013). Conversely, the effects of dual taxation appear to be fairly consistent across presentations, paradoxically extending to positive memories also. Hornsvelt et al. (2011) found that making eye movements during the activation of positive memories rendered the memories less vivid and less positive, suggesting the use of dual taxation during the installation of a positive cognition as a counter-effective part of the EMDR protocol (van den Hout & Engelhard, 2012).

Furthermore, what remains unclear is whether dual taxation alters the memory due to integration of both tasks in the episodic buffer, or whether the divided attention facilitated by the central executive prohibits the memory material from being fully activated (van Veen et al., 2015). Kavanagh et al. (2001) argues that dual taxation does not alter the memory, but actually allows clients to better focus on them. Some studies support this supposition, having found distraction tasks to facilitate exposure and habituation to feared stimuli (e.g., Johnstone & Page, 2004; Oliver & Page, 2003; Penfold & Page, 1999). However, these findings are at odds with earlier work (Foa & McNally, 1996; Rodriguez & Craske, 1993). It is possible that EMDR may be an example of an exposure therapy that yields favourable results from having reduced attention to a feared stimulus; however, this is not a popular assertion, with a greater body of research seemingly evidencing EMDR as an information processing model (Gunter & Bodner, 2009; Rodgers & Silver, 2002).

1.5.2.1 Physiological Effects.

The working-memory account does not offer predictions about the effect of eye movements on arousal, yet, at present the majority of research suggests eye movements and other forms of dual taxation are associated with a dearousal response, observed by

decreased heart rate/skin conductance (Barrowcliff et al., 2004; Sack et al., 2008) and increased HF HRV (parasympathetic tone; Elofsson et al., 2008). However, some studies have shown eye movements to be associated with more arousal compared no eye movements, namely increased finger temperature and breathing rate, (Elofsson et al., 2008) and decreased HF HRV (Gunter & Bodner, 2008). The contrasting changes in arousal may be due to the different physiological measures used across studies (e.g., HF-HRV vs. electrodermal arousal), and task duration (e.g., 96s vs 25s; Barrowcliff et al., 2004; Gunter & Bodner, 2008), or alternatively an epiphenomenon of eye movements/ dual taxation, or likewise relate to other treatment mechanisms at play (e.g., the orienting reflex).

1.5.2.2 Brain Work Recursive Therapy.

As currently understood the BWRT protocol appears to incorporate elements of dual taxation, given suitable distractor tasks have now been extended beyond eye movements, or any other visuospatial or bilateral tasks. Arguably, the therapist's abrupt increase in volume and speed of talking evident at two stages; the '*moment of now*' and the '*recursive looping*' (see Table 4 cited in journal paper), constitutes a distractor task equating to the auditory shadowing utilised by Gunter and Bodner (2008). At these times the client is seemingly holding a mental image in mind, whilst attending to the therapist's rapid speech and instruction. Watts (2014) elucidates the rapidity of speech as essential to 'overload' the Central Nervous System (CNS), preventing extraneous environmental data from being simultaneously processed, which could otherwise interrupt the 'installation' of a new neural route. Although the rationale differs, semantically it appears both therapies are attempting to tax or overload the CNS to aid reconsolidation and installation of adaptive information. Also, the activation of stored information then used to perform cognitive operations is located in WM (Baddeley, 1998), therefore, as a theoretical heuristic it appears sensible to consider the role of WM in BWRT.

Moreover, both EMDR and BWRT employ within-session subjective arousal ratings in relation to the target memory, to guide the mental processing which is the densensitisation and recursive looping stages respectively. Stimulation sets, or loops are repeated until processing is considered complete, directed by clients scores. The process

of continual reactivation to maintain an image, is an effortful endeavour (Kosslyn, 1994); seemingly this is made more challenging by the rapid attentional switching between memories and tasks evident in both therapies; yet, this may signal the efficacy of the therapy. For example, Maxfield (2004) found that faster eye movements produced larger benefits, and similarly Engelhard et al. (2011) found participants who were more distracted by the dual tasks (evidenced by a large delay in a response time task) demonstrated greater benefits regarding decreased vividness and emotionality of the upsetting memory. In addition, the vividness of the memory is also found to influence the level of cognitive load required to achieve therapeutic effects, with more vivid memories requiring more demanding cognitive tasks, and correspondingly, vague memories requiring less taxing tasks to yield better effects (van den Hout & Engelhard, 2012). Future BWRT studies could test the applicability of the link between taxing WM and the memory-effect, by trialing variations in the rapidity of the therapist's speech to see if/ how this effects treatment outcome.

Like retrospective memories, the WM account suggests flash-forwards (e.g., images about future catastrophes) can also be relinquished of their impact. Engelhard, van den Hout, Janssen, and van der Beek (2010b) compared the effects of 'recall only' and 'recall + eye movements' and found the addition of eye movements led to flash-forwards becoming less vivid and emotional. Comparable results were demonstrated in an analogue study of students presenting with performance anxiety (Engelhard et al., 2012). If the WM hypothesis is pertinent to our understanding of how BWRT may work, or at least partially, then the dual taxation during the installation of the 'preferred response' (*moment of now* and *recursive looping*) and the creation of a positive flash-forward memory (*recursive looping*) appears paradoxical. Similarly, EMDR has received criticism for the seemingly indiscriminate use of dual taxation for negative and positive associations (van den Hout & Engelhard, 2012).

1.6 Clinical relevance

Full, and subthreshold PTSD commonly co-morbid with other mental health disorders and physical health complaints, are highly prevalent, distressing and disabling conditions (Jakovljević et al., 2012; Mylle & Maes, 2004). Consequently, traumatic stress remains an important public health concern due to the ever-increasing societal

costs and burden placed on mental health services (Jakovljević et al., 2012), particularly in light of large scale terror attacks (Jordan, et al., 2004) and wars in Afghanistan and Iraq (Hoge, et al., 2004). The King's Fund carried out a recent review (McCrone et al., 2008) regarding the cost of mental health for the government and taxpayer, including the potential impact that specific interventions may have on such costs. Due to difficulties in establishing trauma prevalence rates, trauma was unfortunately excluded from the review and therefore, cost estimates of treatments for PTSD could not be provided. However, there was an acknowledgement that trauma prevalence rates are likely to have increased given its "links to migration", and therefore, concomitant rises in the cost of treating the disorder for services, such as the NHS, can be anticipated (McCrone, et al., 2008, p7).

Moreover, despite evidence-based treatments demonstrating their effectiveness in treating PTSD (e.g., exposure therapy, EMDR), PTSD maintains its reputation as a challenging psychopathological concept to treat, with treatment failure for this population persisting (Cukor, Spitalnick, Difede, Rizzo, & Rothbaum, 2009). This is evidenced further by a recent meta-analysis reporting higher attrition rates for trauma focused versus non-trauma focused work (Imel, Laska, Jakupcak, & Simpson, 2013). Consequently, it is clinically pertinent that alternative cost-effective and well-tolerated psychotherapeutic approaches for trauma are considered. BWRT's claims to potentially alleviate traumatic symptomology in a single session, or very few sessions (i.e., 1-5), is a welcomed possibility worthy of investigation.

2. Extended Method

2.1 Epistemological Position

The present study was designed and conducted from a pragmatist position. Pragmatism is less concerned with the construction of knowledge itself (ontology; Hall, 2013), but rather the pursuit of human problem-solving. Here, the research problem is of greater importance and the central concern is 'what works' and what enables solutions to problems (Patton, 1990). Consequently pragmatism avoids the contentious paradigm wars and interminable theoretical disputes, instead embracing the positioning of positivists (i.e., seeks objective truth in context-free form) and interpretivists (i.e.,

seeks relative truth of multiple realities) (Martin, 1990), by viewing the measureable world as encompassing both objective and subjective knowledge which can provide deep insight into research problems (referred to as intersubjectivity; Feilzer, 2009). Moreover, pragmatists typically adopt an abductive mode of reasoning, relying on contextual judgements to explain unexpected observations (Morgan, 2007). Unlike induction that tries to generalise findings and deduction that allows for confirmation of existing knowledge/ theories, abduction oscillates between both forms of reasoning and emphasis is placed on ‘the best explanation’ of an observed consequence, through the finding or formation of hypotheses or theories (Parvaiz, Mufti, & Wahab, 2016).

This explanation may only apply to a single case and similarly to inductive reasoning, abduction may produce fallible inferences (Jiang, 2001). Yet, in many circumstances, human reasoning pursues an immediate conclusion even at the risk of later being disproven on the emergence of new evidence. This process is somewhat expected when researching unfamiliar phenomenon and among pragmatists stimulates further inquiry, with consideration given to the transferability of results by defining the level of context-specificity and the study’s generalisability (Shannon-Baker, 2016).

Given the orientation of pragmatism towards problem-solving practical dilemmas in the real world independent of method and underlying theory (Feilzer, 2009), it is unsurprising that pragmatism has been welcomed as the foundation of mixed-method research (Feilzer, 2009; Parvaiz et al., 2016; Tashakkori & Teddlie, 2003). Pragmatism acknowledges the diverse nature of research and promotes the convergence of quantitative and qualitative methods (Creswell & Plano-Clark, 2007) to produce ‘useful’ outcomes with clinical utility (Feilzer, 2009). Conversely, critical realism is another recognised research approach born from the polarisation of positivism and interpretivism which provides a potential scaffold for mixed method research (Creswell & Plano-Clark, 2011). However, a pragmatist approach is better able to cope with potential dissonance at the integration stage of qualitative and quantitative data, as the emphasis is on the “shared meanings” created as an outcome of the integration (Morgan, 2007, P.67). This underpins the intersubjectivity that pragmatism affords mixed methods researchers, highlighting the false dichotomy between “complete objectivity” and “complete subjectivity” (Morgan, 2007, p. 71; Shannon-Baker, 2016).

Additionally, there is an acknowledgement among pragmatic researchers of the unpredictable human element which creates the need to be flexible and responsive to the emergence of unexpected data (Feilzer, 2009); this corresponds to the current research proposed where little is still known, therefore, unexpected data is somewhat envisaged.

SCED methodology shares the pragmatist philosophy, allowing causal inferences that are context-informed to be drawn in a single case (Biglan, 2004; Kratochwill et al., 2010). Furthermore, compared to the broad level of analysis offered by RCTs, SCEDs allow the measurement of theoretically key processes and the testing of effectiveness of interventions under study (Hayes, Levin, Plumb-Villardaga, Villatte, & Pistorello, 2013). Consequently, SCED methodology is congruent with the aims of the current study and was selected for this reason (discussed further below), alongside the supporting epistemology which affords the creative investigation of novel interventions.

2.2 Single Case Experimental Design

SCED with repeated measurement (e.g., a time-series) are a valuable tool to rigorously evaluate a therapeutic intervention with one or a small number of cases (Kazdin, 2011), and have been increasingly used among process researchers when investigating the mechanisms of change in treatment (Ray, 2014). SCEDs also offer a means to assess intervention outcomes and efficacy and are argued to have greater clinical utility and ecological validity of empirical findings than randomised controlled trials/ group comparison designs (Smith, 2012), which are more likely to exclude clients for methodological reasons. In SCEDs, the participant functions as their own control by comparing pre-intervention baseline levels of dependent measures with change that follows the implementation of the intervention (Ray, 2014).

Often, SCEDs adopt a 'withdrawal/ reversal' design or A-B-A design, whereby a non-treatment phase (A) is followed by the treatment phase (B), which is then concluded by the withdrawal of the intervention and a return to a non-treatment phase (A). Effectiveness of treatment would be surmised if the participant showed no improvement during A phase, demonstrated reliable improvement in B phase, and

resumed a lower rate of improvement during the final A phase (Ray, 2014). Despite such designs being considered the most rigorous of the SCED approach, particularly if the intervention is withdrawn and reintroduced multiple times (i.e. A-B-A-B-A-B) (Kratochwill et al., 2010; Ray, 2014), ethical and pragmatic concerns are raised from this method within the field of psychotherapy. Namely, that the testing of treatments that are typically designed to have a lasting effect cannot be unlearned or reversed, in addition to the removal of potentially ameliorative interventions which could lead to an inadvertent deterioration in participants wellbeing (Rassafiani & Sahaf, 2010). Consequently, the A-B-A design was not appropriate for use in the current study.

The multiple-baseline design is a notable alternative to the withdrawal/ reversal designs (Barlow, Nock, & Hersen, 2008) and is considered contributory to evidence-based practices (Kratochwill et al., 2010). This design involves multiple participants in a replication context consisting of repeated A-B designs (Smith, 2012). The introduction of the intervention (B) phase is staggered temporally across multiple participants (minimum of three), which allows for greater control of extraneous variables and credibility of results if the intervention phase resulted in improvement across multiple-participants following a stable or deteriorating baseline of the targeted behaviour (dependant variable; Ray, 2014). Additionally, the noncurrent introduction (i.e. staggered application) of the intervention across participants reduces threats to internal validity, for example, maturational or history effects (Barlow et al., 2008).

The multiple-baseline design was feasible with regards to the scope of this study and the ability to produce appropriate data to answer the hypotheses and the aims of the study (above and beyond a group comparison design). Six participants were recruited which allowed demonstration of replication effects (minimum of three; Kratochwill et al., 2010) and protection against possible attrition. In addition, the repeated measures taken during the consolidation phase, and one- and two-month follow-ups, permitted the evaluation of response acquisition and maintenance across participants following the treatment intervention.

2.3 Participant inclusion and exclusion criteria

All participants had previously taken part in the TAU 10-week psycho-educational group programme. Frequently for clients, their attendance of the group often uncovers unaddressed psychological symptomatology, and instead of referring on, the psychology team are attempting to address these issues within the service. Currently the prevailing model utilised in the service is BWRT, which anecdotally has yielded reports of clinical efficacy from treating therapists and clients.

To ensure participants included in the study were representative of the non-complex trauma population, participants were required to be exposed to at least one non-complex traumatic event and to score 8 or more on the IES-6 which was comparable to the IES-R cut-off of 24 for partial PTSD (Thoresen et al., 2010). As the current study investigated the effects of BWRT to treat non-complex trauma, participants in receipt of, or due to receive, any form of psychotherapy were excluded from the sample. However, individuals receiving current psychotropic medication were included as this was considered a frequent and, therefore, ecologically valid practice of many accessing mental health support. Participants were further excluded if they had a brain injury and/or head trauma that had created significant cognitive impairments that may interfere with their ability to engage with the BWRT process, this also included any clients experiencing current psychosis. Lastly, participants were excluded if they disclosed pregnancy⁵¹. A total of eight participants agreed to take part; two participants were excluded on the basis of their trauma being considered too complex (i.e., repeated sexual abuse) for the focus of this study, but were still able to access BWRT within the service. Each participant was assessed independently and functioned as their own control, therefore, the significance of individual variation as a possible confounder of results was reduced.

2.4 Overview of Measures

Aligned with the study aims and epistemological position taken, a combination of qualitative and quantitative measures were utilised to assess the process and outcome

⁵¹ Pregnant women were excluded as recommended by the founder Terence Watts. Given BWRT has not been subject to controlled research thus far, the capacity for BWRT to cause iatrogenic effects is unknown and, therefore, excluding pregnant participants was considered a necessary precaution.

of BWRT. Some additional information relating to the measures that is not covered in the remit of the journal paper is outlined below, including some consideration given to alternative measures that were not selected and the reasons for this where appropriate. Online measures hosted by Qualtrics (secure survey platform) were piloted by colleagues before administration.

2.4.1 Impact of Events Scale.

The IES-6 is correlated strongly with longer versions of the instrument (Thoresen et al., 2010), suggesting some PTSD measures might contain a number of items which are less specific to traumatic stress symptomatology (Giorgi et al., 2015). If such items are superfluous, a shorter version of the instrument would more efficiently screen traumatic stress “at risk” individuals. Moreover, it is an easy measure to administer which was considered of high importance due to the frequency of administration throughout the study, and the need to reduce participant burden and careless responding particularly when recruiting from a CFS sample where fatigue is a concern.

To the author’s knowledge the IES-6 has only been utilised in four published papers to date (Arnberg, Michel, & Johannesson, 2014; Giorgi et al., 2015; Naghavi, Shabestari, & Alcolado, 2013; Thoresen et al., 2010); in two of these papers the IES-6 was administered as part of the 22-item IES-R. Consequently, for these two papers, one being the measure development paper, it is unknown whether participants would have responded differently if asked to answer six questions only, raising some concerns regarding the face validity of the measure. However, within this study and the two other respective studies utilising the IES-6, the performance of the IES-6 was encouraging and was not met with any apparent difficulties or inaccuracies in participant responding.

2.4.1.1 Alternative Measure.

The Trauma Screening Questionnaire (TSQ; Brewin et al., 2002) is a 10-item symptom screen that is designed for use with survivors of all types of traumatic stress. However, despite being a brief measure this was not chosen due to the yes/no response format which provides limited information regarding symptom severity.

2.4.2 Hospital Anxiety and Depression Scale.

To ascertain an in-depth insight into a participant's QoL it is recommended to have more than one scale offering differing perspectives and symptom domains (Roth & Fonagy, 2005), for example, a general (e.g., SF-12) and a domain specific (e.g., HADS) QoL measure. The HADS functioned as a domain specific QoL measure which tracked participant's fluctuations in mood and was triangulated with any changes noted in the IES-6 score as both measures were completed concurrently at each experimental phase. Additionally, this measure was routinely collected within the service as part of the pre- and post-data for the 10-week TAU group and, therefore, a continuation of this measure was considered less burdensome to participants.

Confirmatory factor analysis of the HADS identified a three-factor solution, namely anhedonic depression, autonomic anxiety and negative affectivity (Cosco, Doyle, Ward, & McGee, 2012). For clinicians or researchers utilising this measure as a means of assessing anxiety and depression symptoms specifically, having a general psychological distress factor may be less helpful. Fortunately, in this study the HADS was not utilised as a case-finding and outcome measure of anxiety and depression. Additionally, the lack of somatic items means the HADS largely avoids the symptom overlap between somatic illnesses and mood disorders (Lee, Wu, Chien, Fang, & Hung, 2016).

2.4.2.1 Alternative Measure.

The Depression Anxiety and Stress Scale -21 (DASS-21; Lovibond & Lovibond, 1995) is a revised measure of the DASS-42 and offers assessment of anxiety, depression, and related constructs. However, the HADS was chosen due the existent use as a service measure and the lesser items which was considered more acceptable to participants with limited concentration.

2.4.2.2 Abbreviated Hospital Anxiety and Depression Scale.

The abbreviated HADS-4 was created for administration during the baseline phase to minimise participant burden during the bi-weekly data collection. Here, items were selected separately by factor, utilising both item-factor scale correlations and

content validity considerations which remains a popular approach among the literature (Francis, 1996; Recklitis, Yap, & Noam, 1995; Thoresen et al., 2010). Reduced coverage of the target domain was considered an acceptable compromise for the purpose of the measurement as a general construct of psychological distress; however, with fewer items, validity and reliability of the short form was harder to achieve. Poor reliability is more common with short forms (Smith, McCarthy, & Anderson, 2000), yet, thresholds remain the same whereby a reliability equal to .65, would mean 35% of the variance of that measure is random or error (Nunnally & Bernstein, 1994). The HADS-4 yielded a suboptimal internal consistency of .47, despite selecting the highest loading factors which affords the best chance of preserving a high internal consistency estimate of reliability (Smith et al., 2000). Consequently, interpretations of participants HADS-4 scores were made with caution. Retrospectively, the addition of further items could have diversified the item content and potentially improved the psychometric properties. Alongside this, a priori estimate of the short forms reliability could have been undertaken to determine whether the abbreviated measure would perform adequately, or whether the full measure should have been retained.

2.4.3 Short Form Health Survey-12.

The SF-12 is a downsized version of the SF-36 (De Smedt et al., 2013); the empirical validity of the SF-12 has fallen 10% below that observed for the full item SF-36 (Ware, Kosinski, & Keller, 1996) due to having fewer items for each of the eight health concepts. Conversely, empirical studies have demonstrated the SF-12 to be a practical alternative which rarely misses changes in physical and mental health identified by the SF-36 (Ware, Kosinski, & Keller, 1995). Therefore, an exchange of marginally less precision for ease of administration was deemed appropriate for the purpose of this study, in addition to the existing use of SF-12 as a routine service measure.

2.4.3.1 Alternative Measure.

EuroQol-5D (EQ-5D; The EuroQol Group, 1990) is a generic, widely used instrument that provides an overall view on a person's general health, however, the

measure only offers a global score of health and not a delineation between physical and mental health like the SF-12.

2.4.4 Perceived Arousal and Vividness Likert Scales.

Within-session PALs ratings are part of the BWRT protocol and were administered alongside image vividness ratings, an additional measure introduced to also assess memory quality before and after the intervention. Such ratings are prevalent among the EMDR process literature and have demonstrated fairly consistent results for a reduction in subjective vividness and emotionality/arousal ratings of the target memory following the intervention. Memory degradation is a shared aim of BWRT and, therefore, it was considered helpful to include both ratings in this study to offer some comparisons to the extant EMDR literature, which as currently understood, is the therapy most akin with BWRT. Importantly given the subjectivity of such ratings, participants reported scores are liable to demand characteristics, whereby participants may infer the therapist expects decreases in their ratings following the recursive looping process, leading them to report expected phenomenological ratings as opposed to true changes in their experience of their memory (Lohr, Lilienfeld, Tolin, & Herbert, 1999). This needs to be acknowledged when interpreting within-session ratings.

2.4.5 Heart Rate Variability.

Research has demonstrated that elevated physiological characteristics are modifications that are acquired post trauma (Pitman et al., 2006) and, therefore, it is recommended to use physiological measures to evaluate possible treatment mechanisms and the efficacy of therapies, independent from self-reported symptom measures (Frustaci et al., 2010). Measuring HRV will enable a comprehensive evaluation of the participants' mind and body response to treatment and whether the psychophysiological profile of BWRT reveals anything regarding the possible treatment mechanisms at work.

Many extraneous factors can influence HRV, both on a specific moment to moment level (e.g., moving in the chair) and on a more general level (e.g., age and gender; Nunan et al., 2010). Therefore, consideration of these variables is needed when interpreting results.

2.4.5.1 Alternative Measure.

Skin conductance response is another marker of autonomic activity measured via electro-dermal activity and reflects activity in the sympathetic nervous system (Vetrugno, Liguori, Cortelli, & Montagna, 2003). However, unlike skin conductance HRV is also able to offer an index of parasympathetic activity, and this can be triangulated with time domain, and frequency domain methods (Laborde, Mosley, & Thayer, 2017).

2.5 Fidelity Checklist

The two independent reviewers rated the therapist's competence and treatment fidelity to the BWRT model using a pro-forma created by the author in the absence of a published adherence scale. Utilising the following response scale: no; somewhat; and yes, therapy audio recordings were rated according to the following criteria:

1. Was advice provided consistent with BWRT and/or were discussions in line with the BWRT model?
2. Was there any advice provided that was inconsistent with BWRT (e.g., thought challenging)?
3. Were there any therapy techniques used that were inconsistent with the BWRT protocol (e.g., bilateral stimulation)?
4. Did the therapist complete all fourteen steps of the BWRT protocol?
5. Was the therapist competent in guiding the participant?

Therapists are advised to follow the 14 step BWRT protocol 'rigidly' to achieve the best clinical results (Watts, 2014). Stages from the protocol were incorporated into the pro-forma to check adherence and comprehensiveness. There was 100% inter-rater reliability between reviewers, with all therapists found to remain adherent to the BWRT model and exhibit sufficient competence. Fixed category responses (i.e., no, yes) were utilised instead of a Likert scale, as Likert scales can generate more rater subjectivity and subsequently make it difficult to proffer valid conclusions (Borrelli, 2011). In addition, the inclusion of the 'somewhat' descriptor, provided some indication of the degree the treating therapist met each guideline.

2.6 Interpersonal Process Recall and Change Interview

It is impossible to predict and measure every possible way in which a participant may change during therapy (Elliott, 2002). Therefore, to obtain qualitative information about the process and outcome, both IPR (Timulák & Lietaer, 2001) and a change interview (Elliott, 2012) was facilitated by the primary researcher. Interviews took place one month following the participants BWRT session. IPR involved replaying to participant's short segments of their session audio recordings and asking for their accounts and experiences of these therapy events, including their perception of the therapist at these times. Questions were adapted from Timulák and Lietaer (2001) paper. IPR affords closer access to the actual experience of participants during therapy, minimising post-hoc interpretations by using recordings of the actual therapy session to cue context-specific recall (Elliott, 1989; Timulák & Lietaer, 2001). The therapy events replayed to all participants were stages 4: '*wait state*', 6: '*moment of now*', and 8: '*recursive looping*' as these were considered pertinent and unique parts of the BWRT process. Additionally, participants were asked if there were any other sections that they considered significant and wished to revisit. All participants declined.

The change interview asked participants for their general experiences of receiving BWRT, including helpful and unhelpful parts of therapy and attributions of change. A semi-structured interview schedule (Appendix K) adapted from Elliott (2012) was utilised to achieve comparable qualitative data across participants, but the follow up of topical trajectories in the conversation if appropriate was permitted. All participant interviews were audio recorded. In order to become familiar with the data, audio recordings of the IPR and change interview were listened to more than once. Findings from the change interview were utilised to support or refute any inferences made following analysis of quantitative data. Additionally, interviews also enabled assessment of participant's self-reported change, in particular, whether change could be attributed to experimental manipulation or demand characteristics towards the therapist.

2.7 Ethical Considerations

Standards of good ethical practice were upheld throughout the study and carried out with reference to the code of human research ethics of the British Psychological Society (BPS, 2014).

2.7.1 Informed consent.

Potential participants were identified by the group facilitator (i.e., group participants identifying and communicating further trauma related difficulties they wish to work on) and introduced to the project. Each potential participant was provided with the participant information sheet (Appendix E) which outlined all the relevant information to participation in this study. Interested participants were then asked for their consent to be contacted by the primary researcher to arrange a screening meeting.

The screening meeting allowed for further discussion of the research and what was required of participants, including opportunity to clarify any questions or concerns. Informed consent was gained, and the signed consent was copied twice: one was kept for study records and consequently stored at University of Lincoln, the other made available for the participants to keep as a record (Appendix H). Additionally, participants were afforded a two-day contemplation period following screening to consider the requirements of the study before commencing data collection. The service's assistant psychologist contacted each participant to confirm their continued consent and participation. Following confirmation of continued informed consent, participants took part in the research process commencing with baseline data collection as outlined in the journal paper.

2.7.2 Right to withdraw.

Participants were informed verbally and in written form that they could withdraw from the study at any time, by contacting the primary researcher without any consequence for their care (e.g., they could still receive therapy but not submit their data). They were also informed that they could choose to withdraw their data up until two weeks following their last data collection, but that after this time their data could not be erased as it may already be included in the analysis and reports.

2.7.3 Confidentiality.

This project acted in accordance with the Data Protection Act (1998): participants were allocated a code by which data was collected and stored confidentially utilising a password-protected encrypted USB stick provided by LPFT for research purposes. The majority of participant questionnaire scores were stored on the encrypted

industry-standard platform Qualtrics; however, scoring from any paper-based questionnaires was inputted and saved on the encrypted USB stick and paper copies disposed of in NHS confidential waste bins in line with LPFT policy. Participants were informed that their identity would remain anonymised in any reports and subsequent disseminations of the research. On completion of the study, each participant was given the option to receive a summary of the study findings.

2.7.4 Protection of participants.

Participants' well-being was monitored and supported in line with standard service practice, in addition to the continuation of routine care provided by participants own general practitioners (e.g., pharmacological support was applicable). The treating therapist was encouraged to always provide the treatment they judged to be of most benefit to the participant, and any resulting deviations from the BWRT protocol were captured by the fidelity check, although no deviations were identified by either rater. Lastly, if participants had continued to self-report clinical levels of distress on completion of BWRT, then further support would have been offered by the service in line with their routine clinical practice, for example, extended sessions, onward referral, or discharge if the participant felt subjectively better and no longer in need of support. Only one participant pursued further support with the service after completing BWRT.

2.7.5 Compensation.

To show appreciation for participants' contribution they received a £10 Amazon voucher. This was not considered excessive or coercive, and the voucher was intended to still be given to participants who choose to withdraw from the study, however, no participants withdrew. Participants were also offered travel reimbursement for their attendance of the screening and interview meeting with the primary researcher as this was considered an additional expenditure outside of the parameters of their therapy attendance.

2.8 Analysis

Data from the Polar RS800CX heartrate monitor was uploaded to a secure laptop using software supplied by the device. Frequency domain (power spectral density) analysis and time domain analysis were calculated for selected segments using

the Polar Protrainer 5 software. Further statistical analysis of median group comparisons between pre- and post-intervention recordings for HF and R-MSSD⁵² were conducted using a Wilcoxon Signed Rank Test. This test was selected due to the lack of normality in the data.

Online data (from Qualtrics) was transferred by the primary researcher to an Excel worksheet, which was consequently used to develop all graphs and further analysis. Self-report measures were graphed and inspected with regards to central tendency, trend, variability, and point of change. Central tendency refers to the mean of each phase and mean changes between phases; the trend is defined as progress and direction over time; variability refers to the stability or fluctuation in the data within phases; and the point of change, is the rate of change between adjacent phases, for example, how quickly does the data change when an intervention is introduced or withdrawn (Morley, 2018). Visual analysis interpretations are primarily offered in the journal paper.

Following, self-report measures were subject to reliable change index (RCI) and clinically significant change (CSC) calculations using the criterion specified by Jacobson and Truax (1991). Here these concepts are defined. RCI relates to the extent to which change is beyond the probability of measurement error. The RCI was set at ± 1.96 which equates to a 95% confidence interval around the pre-treatment score. To calculate the RCI value, the test-takers pre-treatment score is deducted from the post-treatment score and then divided by the standard error of the difference (SE_{diff}). The SE_{diff} is calculated using the Standard Error of Measurement of the measure used. These calculations are as follows:

$$RCI = \frac{(\text{pre-treatment score} - \text{post-treatment score})}{SE_{diff}}$$

Figure 9. RCI calculation (Jacobson & Truax, 1991)

⁵² R-MSSD and HF reflect vagal tone and self-regulatory capacity, with higher values in both measures indicating higher HRV and parasympathetic activity.

To calculate the SE_{diff} , the Standard Error of Measurement (SEM) is required for the subsequent calculation (Figure 10).

$$SE_{diff} = \sqrt{2 \times SEM^2}$$

Figure 10: Standard Error of the Difference calculation

The SEM is directly related to a measures reliability: The larger the SEM, the lower the measures reliability (Morley, 2018). The SEM is calculated by multiplying the Standard Deviation (SD) with the square root of 1 and subtracting the coefficient reliability (r ; Figure 11). The coefficient reliability utilised in this study was the Internal Consistency (IC). The IC is considered to most closely align with the conceptual basis for reliability, being largely unaffected by sampling content (i.e., coherency or redundancy of scale items; McCrae, Kurtz, Yamagata, & Terracciano, 2011), which is usually the prevailing source of measurement error for static constructs (Nunnally & Bernstein, 1994). Conversely, an alternative reliability coefficient is test-retest reliability, this reflects the extent to which similar scores are obtained across repeated administrations (Morley, 2018); which creates the potential for estimates to vary considerably depending on the time interval between administrations. Subsequently, the test-retest coefficient can serve to compound the actual reliability of the measure and any actual changes in the measure over time (Morley, 2018); and as a result the IC is typically found to be higher, creating a smaller window of SEM and offering a ‘tighter’ estimate of RCI.

$$SEM = SD \times \sqrt{(1 - r)}$$

Figure 11: Standard Error of Measurement Calculation

Once calculated, the RCI value can be used to assess whether the change between the pre- and post-scores is reliable or not. If the RCI value exceeds ± 1.96 , it can be assumed that the change measured ‘reliable change’ at 95% confidence and is not due to measurement error. Table 13 provides the RCI values per participant, per measure, which were used to assess for reliable change. Non-clinical referent data were used for IES-6 and SF-12 RCI calculations due to a lack of suitable clinical comparison groups.

Table 13

RCI values generated from self-report measures

	1 week follow-up	1 month follow-up	2 month follow-up
Participant 1			
IES-6	3.07*	2.20*	2.20*
HADS-A	-1.62	-0.40	0.81
HADS-D	2.63*	-0.38	-0.38
SF-12 PCS	-	0.26	0.85
SF-12 MCS	-	-0.77	-0.55
Participant 2			
IES-6	2.64*	2.20*	2.20*
HADS-A	0.81	1.21	2.83*
HADS-D	2.25*	2.25*	3.00*
SF-12 PCS	-	-0.59	0.25
SF-12 MCS	-	-2.90*	-3.21*
Participant 3			
IES-6	5.27*	5.27*	5.27*
HADS-A	4.45*	4.85*	5.26*
HADS-D	1.13	1.13	1.88
SF-12 PCS	-	-0.98	-2.16*
SF-12 MCS	-	-5.04*	-4.80*
Participant 4			
IES-6	5.27*	6.15*	5.71*
HADS-A	2.02*	2.02*	3.64*
HADS-D	1.13	2.25*	3.38*
SF-12 PCS	-	-2.73*	-3.76*
SF-12 MCS	-	-2.77*	-2.48*
Participant 5			
IES-6	7.91*	-	6.59*
HADS-A	4.45*	-	3.23*
HADS-D	3.00*	-	3.00*
SF-12 PCS	-	-	-3.32*
SF-12 MCS	-	-	-0.81
Participant 6			
IES-6	6.15*	7.47*	7.03*
HADS-A	4.85*	4.45*	4.85*
HADS-D	1.50	1.88	3.00*
SF-12 PCS	-	3.22*	4.66*
SF-12 MCS	-	-4.55*	-3.10*

Note. IES-6: Impact of Events Scale-6, HADS-A/HADS-D: Hospital Anxiety and Depression Scale with respective anxiety and depression subscales; SF-12: Short-form Health Survey with physical component scale (PCS) and mental component scale (MCS); - : Not collected; RCI values > ± 1.96 demonstrate reliable change; *: RCI values meeting criterion for reliable change

If change is considered reliable, further evaluation can be undertaken to determine whether this change is clinically significant: that is, whether the individual has moved from a clinical threshold, to that of a 'normal', healthy sample. This can be conducted using one of the following three criteria:

Criterion a – CSC is met if an individual's post-intervention score is *greater than* two SDs from the mean score of a *clinical* group.

Criterion b – CSC is met if an individual's post-intervention score is *within* two SDs of the mean score of a *non-clinical* group.

Criterion c – CSC is met if an individual's post-intervention score is closer to the mean of the non-clinical group than the clinical group.

Criterion b and c were utilised in the current study dependant on the availability of appropriate referent data for each measure. Clinical referent data were utilised only when considered sufficiently similar to the current sample. For example, studies utilising the IES-6 included trauma samples ranging from victims of non-domestic violence (Thoresen et al., 2010), needle stick injury (Naghavi et al., 2013), natural disaster (Arnberg et al., 2014), and bank robbery (Giorgi et al., 2015). Despite the trauma focus of these studies, the nature of the trauma exposure was not considered sufficiently similar to the current sample to use as reference data. CFS sample data were available as a clinical comparison group for the HADS regarding physical health compatibility, with the current sample sharing CFS symptomology. Table 14 provides the referent data utilised in the current study to calculate RCI and CSC cut off scores, including the type of sample used.

Table 14

Referent data of group norms for RCI and CSC calculations

Clinical norms						Non-clinical norms						
Measure	Paper	Sample (N)	M	SD	Alpha	Paper	Sample (N)	M	SD	Alpha	Cut-off	SEM
IES-6		-	-	-	-	Arnberg et al. (2014)	Community (541)	2.9	3.6	.80‡	8†	1.61
HADS-A	McCue, Buchanan, & Martin (2006)	CFS (494)	8.84	4.85	0.87	Crawford et al. (2001)	Community (1792)	6.14	3.76	.82	7.32	1.75
HADS-D			8.58	4.11	0.79			3.68	3.07	.77	5.78	1.88
SF-12 PCS		-	-	-	-	Ware et al. (1996)	Community (2, 329)	50	10	0.89§	30.4	3.32
SF-12 MCS		-	-	-	-			50	10	0.76§	30.4	4.9

Note. IES-6: Impact of Events Scale-6; HADS-A/ HADS-D: Hospital Anxiety and Depression Scale with respective anxiety and depression subscales; PCS: Physical Component Scale; MCS: Mental Component Scale (subscales of the short-form health survey); CFS: Chronic Fatigue Syndrome; N: Number; M: Mean; SD: Standard Deviation; SEM: Standard Error of Measurement used for RCI and CSC calculations.

†A total score of 8 or more was utilised as an external criterion to determine CSC, derived from sensitivity and specificity analysis of various cut off scores (Thoresen et al., 2010).

‡Cronbach Alpha taken from the development paper (Thoresen et al., 2010) based on a clinical trauma sample, in absence of reliability data for non-clinical samples. All trauma papers using the IES-6 reported comparable reliability coefficients for the clinical samples used.

§Reliability data based on a non-clinical sample of N=232 which was taken from the same paper, due to the lack of reporting of reliability data for the full community sample.

2.8.1 Critique of analysis methods.

2.8.1.1 *Visual analysis.*

Visual analysis is considered the hallmark of single case research when interpreting the effects of an intervention (Kratochwill et al., 2010; Lane & Gast, 2014; Ray, 2014). An analysis of baseline to intervention contrast is considered an “authentic demonstration of intervention effect” (Vannest, Davis, & Parker, 2013, p. 61) which can be readily seen in well-designed graphic displays (Cooper, Heron, & Heward, 2007). However, although visual analysis is fundamentally supported as the most reliable method to interpret SCED findings, when treatment effects are moderate and less obvious the reliability of visual analysis can be compromised, leading to erroneous interpretations of intervention effect, or disagreement between visual judges (Lenz, 2013).

Despite the need for objective analysis of data the application of statistical methods would be inappropriate (Lane & Gast, 2014; Morley, 2018; Ray, 2014). SCEDs typically have low numbers of data points which negatively affects the normal distribution, in addition to, the characteristic repeated observations of a selected phenomenon over time, with the high likelihood of these observations being related (i.e., auto-correlated). Consequently, the fundamentals of single-case designs violate both the normality of distribution and independence of observations parametric assumptions required for inferential statistics (Barlow et al., 2008). Therefore, the use of statistics would be redundant. However, this has prompted the discussion and use of effect size estimations as an adjunctive to support visual inspection of graphical illustrations of data (Parker & Hagan-Burke, 2007), aiding measurement precision and allowing for cross-case comparisons and meta-analyses (Lenz, 2013). This is considered further below.

2.8.1.2 *Fisher Dual Criterion.*

Effect size estimations are a quantitative practice unaffected by the requirements and assumptions of the statistical inference and, therefore, have been increasingly promoted in the SCED literature as a useful adjunct to visual analysis in supporting clinical decisions about treatment effects (Morley, 2018). Yet, there is no current

consensus on what effect size methods should be used for SCEDs, with each bearing their strengths and limitations (Lenz, 2013; Ray, 2014).

The Percentage of data exceeding the median (PEM) method was a more recent addition to the SCED literature, calculating treatment effect sizes using the median value of baseline data (Ma, 2006). Data predominantly on the therapeutic side of the median would be interpreted as the intervention being effective, and conversely, data remaining on the contra-therapeutic side of the median, or data that oscillates above and below the median, would lead the researcher to conclude the intervention as ineffective (Lenz, 2013). The PEM method is less vulnerable to Type II errors (i.e., concluding the intervention had no effect when it did) unlike the percentage of non-overlapping data procedure which uses only one data point in the baseline phase to calculate treatment effects. Contrastingly the PEM approach utilises all baseline data, and therefore, is able to accommodate possible outliers in data sets that may otherwise negatively affect the evaluation of an intervention, particularly if data points approach the ceiling or floor of the score range (Lenz, 2013). However, the PEM has also been criticised for yielding inflated effect sizes, promoting Type I errors (i.e., concluding the intervention had an effect when it did not) due to a failure to detect changes, or lack thereof, in trend across phases (Wolery, Busick, Reichow, & Barton, 2010), a seeming weakness of most overlap methods (Lenz, 2013).

Consequently, the current study utilised the Fisher, Kelley, and Lomas (2003) dual criterion (DC) method to mitigate the weaknesses of the PEM method. The DC method utilises both the mean of the baseline data and the projected trend line generated from the same baseline data to estimate treatment effects. Data falling outside of these lines and in a therapeutic direction, would be considered uncommon and, consequently, likely to be due to the intervention (Morgan & Morgan, 2009). The DC method has low observed rates of Type I and Type II errors (Fisher et al., 2003; Morgan & Morgan, 2009) and is subsequently considered a simple, yet rigorous tool for objective and conservative analysis of SCED data.

2.8.1.3 RCI and CSC method.

RCI and CSC analysis allow examination of an individual's response to treatment, which is a perspective often lost in group pre- and post-designs (Wise, 2004). Yet, the RCI and CSC method has been criticised for the predominant focus on 'symptom change' and the potential blind-spots this can create when assessing for meaningful change post-intervention. Kazdin (2001) recommends that symptom saturated measures should also be accompanied by other forms of assessment, for example, measures pertaining to overall health-related-quality of life and not just a targeted disorder/ disease group in order to mitigate potential blind spots. Additionally, Kazdin (2001) suggests that the movement of an individual from a clinical to normative group when determining CSC may be somewhat arbitrary. Failure to move threshold can result in a treatment being considered ineffective, despite improvements in daily functioning being depicted elsewhere (e.g., qualitative report). Similarly, the RCI method may also attribute modest improvement on an individual's scores to measurement error, where in fact this could represent meaningful change (Hageman & Arrindell, 1993).

Given these shortcomings, it is important to utilise a comprehensive battery of measures that assess for symptom change and functional ability when considering the efficacy of psychotherapeutic interventions (Wise, 2004). Notwithstanding, the RCI and CSC methodology offers a welcome shift from evaluating group outcomes, to offering investigation of individual change within these groups. In consideration of the aforementioned critique, the current study utilised a comprehensive psychosomatic measurement strategy to assess change, alongside qualitative change interviews to invite participants to comment directly on the effects of the intervention.

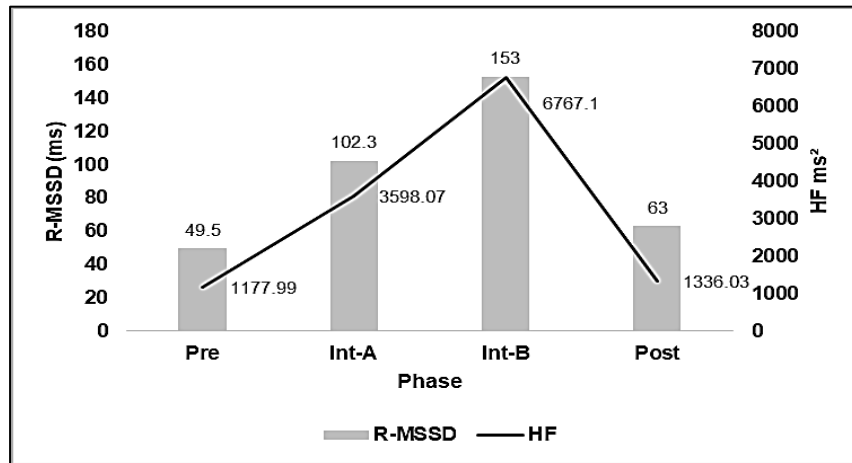
3. Extended Results

3.1 Heartrate Variability

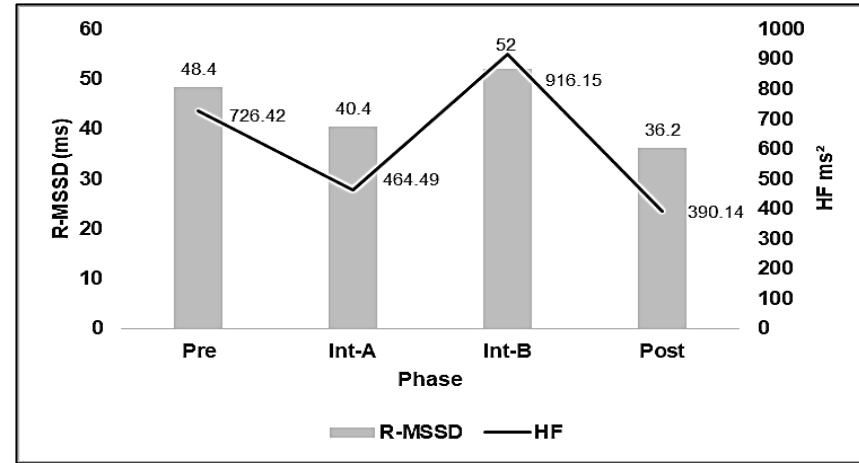
Further analysis were conducted on the HRV variables; HF and R-MSSD, to assess for median group comparisons between pre- and post-intervention recordings. A Wilcoxon Signed-Ranks Test indicated that the change in median from pre-intervention HF, Mdn= 670, to the median of post-intervention HF, Mdn= 1014, did not elicit a statistically significant change ($Z = 1.15$, $P < .249$). Similarly, the change in median from pre-intervention R-MSSD, M=39, to the median of post-intervention R-MSSD, M=58, was also not statistically significant ($Z = 1.57$, $P < .116$), despite both indices increasing in a therapeutic direction pre-to-post. R-MSSD and HF indices across the study phases have been graphed per participant for visual illustration (see Figure 12).

In addition, as per Task Force (1996) recommendations all available indices from frequency and time domain analyses were recorded (LF; LF/HF; SDNN; see Table 15); however, interpretations were not made due to the physiological ambiguity of these additional variables (Laborde et al., 2017).

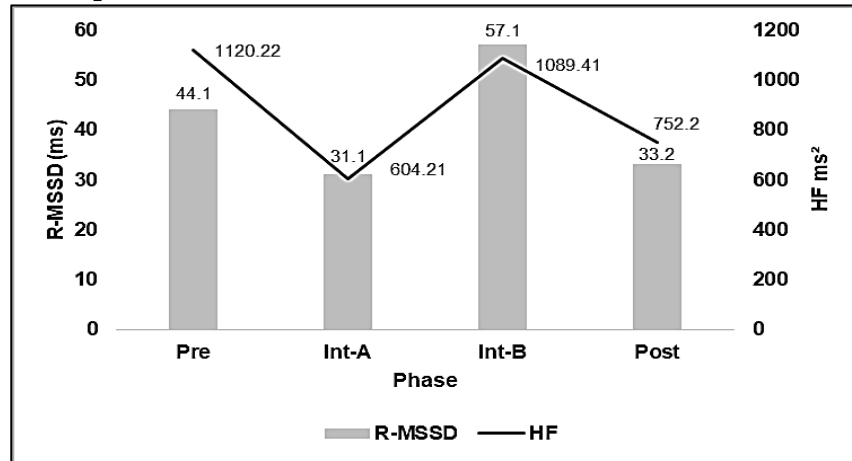
Participant 1



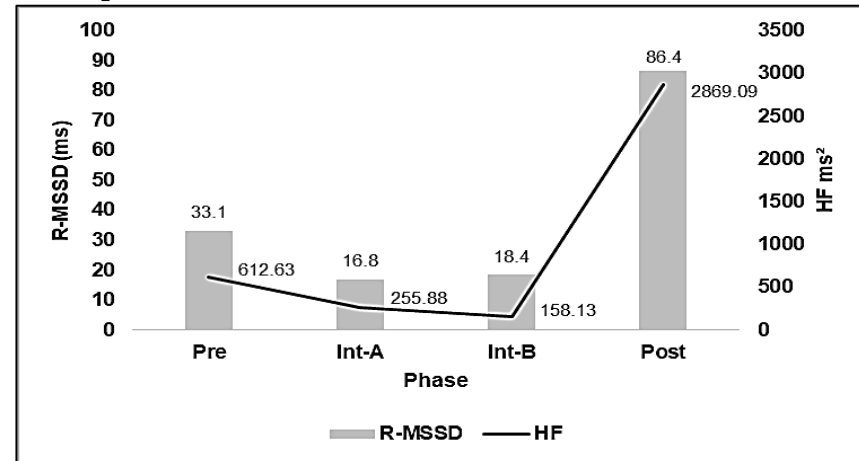
Participant 2



Participant 3



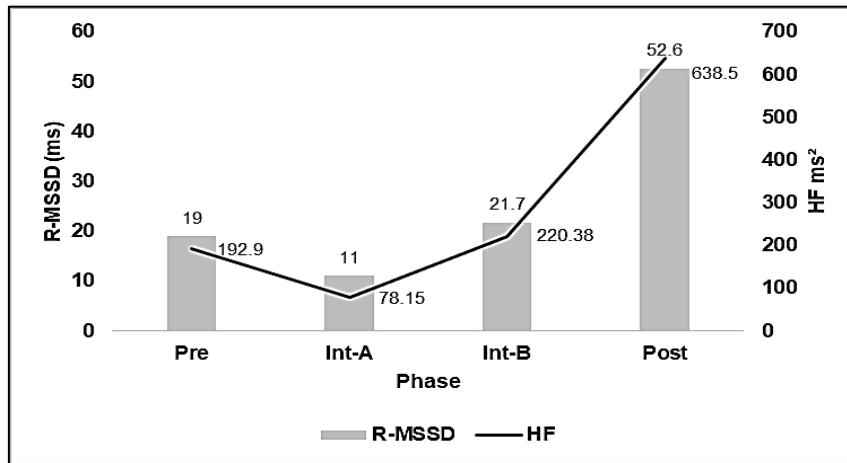
Participant 4



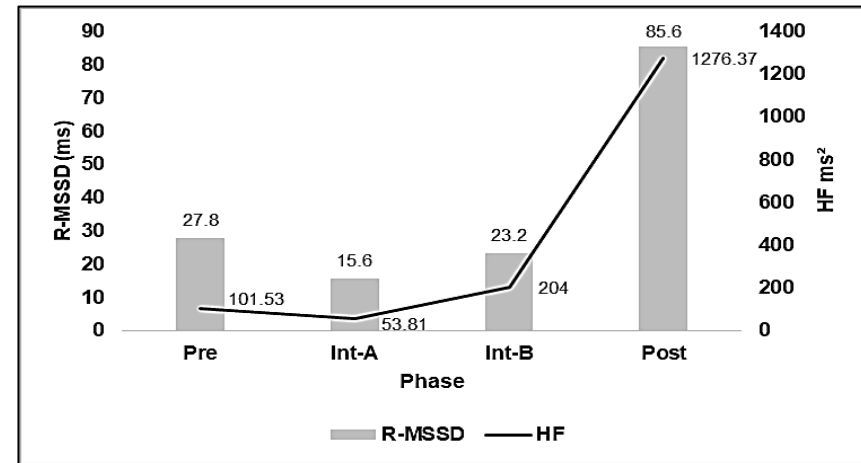
Note. R-MSSD: square root of the mean of the sum of the squares of differences between adjacent R-R intervals; HF: High Frequency; Pre: Pre-intervention; Int-A: Intervention-A (Beginning of BWRT session); Int-B: Intervention-B (End of BWRT session); Post: Post-intervention (one-month follow-up).

Figure 12. HRV data collected across study phases

Participant 5



Participant 6



Note. R-MSSD: square root of the mean of the sum of the squares of differences between adjacent R-R intervals; HF: High Frequency; Pre: Pre-intervention; Int-A: Intervention-A (Beginning of BWRT session); Int-B: Intervention-B (End of BWRT session); Post: Post-intervention (one-month follow-up).

Figure 12. Continued...

Table 15

HRV variables extrapolated pre- and post-intervention in line with Task Force (1996) recommendations

	Pre-Intervention					Post-intervention				
	SDNN (ms)	R-MSSD (ms)	HF (ms ²)	LF (ms ²)	HF/LF (%)	SDNN (ms)	R-MSSD (ms)	HF (ms ²)	LF (ms ²)	HF/LF (%)
Participant 1	66.2	49.5	1177.99	860.27	137	65.0	63.0	1336.03	963.84	72.2
Participant 2	54.4	48.4	726.42	1067.21	147	68.1	36.2	390.14	753.57	193.2
Participant 3	73.1	44.1	1120.22	2186.91	195.3	47.6	33.2	752.20	909.17	120.9
Participant 4	47.4	33.1	612.63	687.20	112.2	82.2	86.4	2869.09	1952.06	68.1
Participant 5	31.3	19.0	192.90	237.20	123	56.0	52.6	638.50	607.78	95.2
Participant 6	130.7	27.8	101.53	173.13	170.6	110.6	85.6	1276.37	1610.24	126.2

Note. SDNN: standard deviation of all R-R intervals; R-MSSD: square root of the mean of the sum of the squares of differences between adjacent R-R intervals; HF: high frequency (0.15–0.40 Hz); LF: Low frequency (0.04–0.15 Hz); LF/HF: Low frequency/ high frequency ratio (1.5-2.0); Pre-Intervention (Screening); Post-intervention (one-month follow-up).

3.2 Summary of Results for each Participant.

The following section offers a narrative synthesis of the findings per participant, with consideration of all the results taken from the quantitative and qualitative measures (for tabulated/ graphed results, please see HRV data displayed above and the journal paper).

3.2.1 Participant one.

Participant one reported a reliable change on the IES-6 dependent measure; however, this failed to reach clinical significance. Visual analysis of the data indicated that there was not a marked difference in level following the BWRT intervention. Moreover, the projected trend line from baseline data suggested participant one deteriorated more than would have been expected in the absence of any intervention. However, all the follow-up phase data points remained below the baseline median, and therefore, using the DC method could be attributed to measurement error. Yet, even so, the DC effect size estimate indicates the effectiveness of the intervention to be within the low end of the debatably effective range (0.6), demonstrating a change has occurred, yet, the magnitude of this change would not be considered clinically important. The HADS and SF-12 demonstrated some improvement, yet, with the exception of the HADS-A and MCS subscales, both measures demonstrated regression beyond pre-intervention baseline scores. Some of these noted reductions may have been influenced by external stressors reported by the participant, relating to unemployment and increased demands regarding her son during the follow-up data collection.

Conversely, participant one's self-reported scores on the in-session process measures suggested notable reductions in vividness and emotionality/ arousal of the target memory after two recursive loops. This was concurrent with therapeutic increases in HF and R-MSSD recordings taken at the start and end of the BWRT session. Although HRV indices taken at one-month follow-up showed some reversion, treatment gains here were maintained comparative to pre-intervention recordings. Noteworthy is the discrepancy between physiological and self-report data, with the exception of the in-session ratings. Despite her efforts participant one struggled to connect to her trauma memory, meaning her noteworthy increase in HRV during the BWRT session (surpassing her study peers) may be a product of her avoidance or cutting off from her

experience, leaving her HRV intact. This may be further contextualised by the qualitative commentary provided by participant one.

Participant one appeared to struggle the most with the BWRT process, commenting on the overall experience as ‘hard work’. This extended to difficulties freezing the target memory, visualising her preferred response, and engaging with the *recursive looping*. Seemingly, participant one was distracted by her own internal dialogue, battling with self-doubt, and doubt regarding the utility and effects of BWRT during the process itself, for example, ‘is it going to work or just stir some other things up’ – ‘can I hold this concentration’. Given the presence of cognitive avoidance and distraction on unspecified stimuli, it is somewhat unsurprising that participant one failed to demonstrate marked change unlike her counter-parts. Although participant one reported some lasting reductions in memory saliency at follow-up, the in-session ratings given may not reflect true phenomenological changes, but rather participant one’s inferences that the therapist expected decreases in ratings following the *recursive looping*. Alternatively, the in-session ratings alongside the recorded reductions in arousal (decrease HR; increase HRV) may offer some evidence of within-session emotional and physiological habituation, as a product of the brief exposures that participant one endured; however, this was not sufficient for these therapeutic changes to be maintained and reflected in self-report measures at one-week follow-up.

3.2.2 Participant two.

Participant two reported a reliable improvement on the IES-6 trauma measure, yet, this failed to meet clinical significance due to their pre-intervention score lying within the non-clinical range. The largely positive baseline phase trend, albeit variable, contributed to a projected trend into the follow-up phase which suggested the participant would have demonstrated the same improvement in the absence of intervention. Nonetheless, the effect size indicated the effectiveness of the intervention within the high end of the moderately effective range (0.8), given 4 of the 5 data points were below the median and projected trend. Similarly, through visual inspection the HADS-4 demonstrated an effect surpassing trend projection, albeit the first three data points of the follow-up phase were overlapping baseline data. However, the full HADS score yielded reliable and clinically significant improvement on the HADS-D subscale

and further reliable improvement was demonstrated on the MCS, alongside a marginal regression on the PCS at the two-month follow-up.

Like participant one, participant two demonstrated reductions on the in-session process measures, alongside a concomitant decrease in HR and increase in HRV indices which again may be representative of emotional and physiological habituation. An increase in HRV was not maintained at two-month follow-up despite continued improvement noted on self-report measures. Given the subclinical levels of trauma symptoms reported at pre-intervention, this result may be an artefact of floor effects when considering the impact of trauma on HRV hiding a possible effect of the independent variable (BWRT), or alternatively, this could be due to external influences beyond the study, such as diet or sleep affecting HRV.

Participant two qualified the therapeutic effects of BWRT as ‘very good’ with ‘quick positive results’. There was an acknowledgment of the concentration required to focus on the target memory and listen to therapist instruction; however, unlike participant one this did not prohibit participant two from being able to maintain engagement in the process. In fact, participant two reported accompanying feelings of relaxation and ‘warmth’ upon generating their preferred response. Notably, this change in affect and physiology was within 1-2 minutes of the initial exposure to the memory which had caused participant two to become tearful and emotionally ‘overwhelmed’.

3.2.3 Participant three.

Participant three demonstrated a reliable and clinically significant therapeutic change on the IES-6 dependant measure, the HADS-A subscale, and the MCS. Reliable improvement was also shown on the HADS-D and PCS. Visual inspection of the IES-6 shows a large and immediate response following the intervention, and a flattening effect in responding during the follow-up phase, evidencing both stability and durability of effects. A similar visual was depicted on the HADS-4, with comparable effect size estimations (1.0) indicating maximal effectiveness of the intervention.

Participant three self-reported a rapid reduction in memory vividness and emotionality after one recursive loop, and like participant two this was also accompanied by therapeutic changes on HR and HRV pre-post the BWRT session (Int-

A; Int-B). However, at the one-month follow-up both HF and R-MSSD were found to regress beyond initial baseline levels. At screening participant three had disclosed taking cardioactive medication which influences HR, and therefore, may have artificially skewed HRV. Consequently, participant three's physiological results are interpreted within these parameters.

Participant three also shared the demands of concentration and 'energy' required to maintain engagement with the BWRT process, yet despite this, reported feeling 'more in control' when compared to his previous experience of hypnotherapy. Furthermore, when enacting the *wait state* and freezing the target memory, participant three reported heightened physiological (i.e., increased breathing rate) and emotional (i.e., dread) arousal commensurate with reactivity expected in exposure-based therapies, which at the end of the session was replaced by feelings of calmness and 'elation'. Participant three spoke of the 'confusion' he was met with, when being unable to generate the discomfort attached to his target memory following the *recursive looping*; given he had reported experiencing '18 years of negativity' due to the toxicity of this memory. He reported the *recursive looping* as challenging, conceptualising this as 'a race' to move between memories at speed. Subsequently, he disclosed changing the memories to their associated emotions to be better able to move between these emotional states as prompted by the therapist. Despite participant three's altered approach, the effects of the intervention were not compromised, suggesting the content of the therapist's instruction may be less important than the act of dual taxation itself (i.e., it is the divided attention that achieves the therapeutic effects). Moreover, changes to memory quality were noted, for example, 'watered down' – 'foggy', and these changes were upheld when the participant encountered situations that would have previously triggered associated unwanted thoughts and feelings. For example, previously participant three would walk his dog via a wooded track with the dog lead wrapped around his hand as a defence in the event of an attack; yet now, he described a very different disposition, one of relaxation, and is no longer inclined to engage in defensive behaviours. Additionally, of note, is the self-reported effects on physical health, with participant three describing increased energy, exercise, and weight loss, as secondary therapeutic effects resulting from the intervention.

3.2.4 Participant four.

Participant four reported a reliable and clinically significant change on the IES-6 and the anxiety and depression subscales of the HADS. Reliable change was noted on the PCS and MCS, however, clinical significance was not met due to participant four's baseline score lying within the 'normal' range. Moreover, despite the considerable variability at baseline, the rate of change on the IES-6 between adjacent phases was immediate, and treatment effects remained stable at the two-month follow-up. The HADS-4 demonstrated a more progressive decrease in scale scores below the baseline median and projected trend. Effect size estimations (1.0) for the IES-6 and HADS-4 placed the intervention within the high end of the highly effective range.

In-session process measures demonstrated the same reductions reported by the rest of the sample, again this was notably after one recursive loop. Conversely, unlike the other participants, participant four experienced a decrease in HF at the end of the BWRT session, and only a marginal increase in R-MSSD and respective decrease in HR. This was incongruent with the participant's subjective reports of arousal reductions, and may therefore be a result of cognitive load, given the participant referenced the experiential demands of the BWRT process in her qualitative account. This explanation makes intuitive sense rather than considering this a contra-therapeutic effect, given participant four's HRV indices taken at one-month follow-up showed the largest therapeutic increase across participants.

As noted, participant four similarly found the therapeutic process taxing, yet, described her overall experience as 'really good' and valued not having to talk, unlike her past therapies (counselling) which she considered an 'interrogation'. Participant four's experience of the *wait state* was met with observable upset (i.e., panicked breathing and tearfulness) and feelings of 'being back there' reminiscent of the reliving experience evoked in exposure-based therapies. However, unlike traditional exposure participant four described this as a transient state, reporting it to 'go away quickly' and soon after to be replaced with feelings of 'warmth', akin to participant two's felt sensations when generating the preferred response. During the *recursive looping* the participant described her closed eyes moving bilaterally with every attempt to switch between memories, and her trauma memory 'feeling further away', a seemingly

distancing effect. When reflecting on her trauma memory at the one-month follow-up, participant four described this as remaining frozen, having no emotion, and reduced detail. In addition, participant four reported broader level changes which she also attributed to BWRT, such as a calmer disposition, development of self-acceptance, and improved relationships with significant others and work colleagues. This was demonstrated when participant four started a new job in the weeks following BWRT. Typically, this would have evoked high levels of anxiety and disabling passivity among her new colleagues; yet instead, she met this challenge with increased confidence and assertiveness.

3.2.5 Participant five.

Participant five demonstrated reliable and clinically significant improvement on the IES-6 and both HADS subscales, including reliable change on the PCS. They also showed the largest magnitude of change on the IES-6 between baseline and follow-up phases, which is concurrent with the temporal effect proposed by the theory underpinning BWRT. However, both the IES-6 and HADS-4 taken three weeks post-intervention returned to baseline levels, which preceded participant five becoming unwell with psychosis and being temporarily hospitalised. Upon returning home, participant five contacted the physical health service and requested to undertake the change interview with the lead researcher. This was completed three months post-intervention and demonstrated participant five's return to therapeutic levels on both measures. Participant five's transient regression impacted on effect size estimations (0.75), indicating the effectiveness of the intervention within the low end of the moderately effective range. Participant five did not consider the BWRT responsible for her relapse, instead attributing this to accumulating stressors beyond the study, such as workplace bullying. Noteworthy is that participant five had experienced previous hospital admissions and had been prescribed anti-psychotic medication prior to, and during her participation in the study.

In-session process measures showed reductions in memory vividness and emotionality; yet, this required three recursive loops to achieve the necessary decrements. This was accompanied by within session increases in R-MSSD and HF, and concomitant reductions in HR congruent with deactivation effects. Therapeutic

increases in HRV indices at one-month follow-up remained intact and had superseded the level of change recorded at the end of the session. This improvement correlated with participant five's self-reported changes in physical health, describing her Myalgic Encephalomyelitis (ME) symptoms as having 'disappeared'.

Participant five's qualitative reports were concurrent with her counter-parts, describing the therapeutic process as requiring considerable concentration and energy; yet, also noticing herself feeling 'immediately better' at the end of the session. Unlike the other participants, participant five reported visualising images of neurons during the *moment of now*, images that had been presented to her at the start of the session when the therapist had provided some brief psychoeducation on how the therapy is proposed to work. Similarly, participant five experienced the speed of *recursive looping* challenging, and at times considered her switching between memories to become an 'unconscious' process that seemingly became easier with each loop. Despite her hospitalisation, participant five experienced BWRT a 'success' for the targeted presenting difficulty/ trauma she had worked on and considered wider reaching changes a further product of the therapy, for example, 'lighter thought patterns' and 'increased confidence'. The memory itself had lost its associated emotion, and comparable to participant four appeared further 'in the distance'. Participant five was enamoured with the rapidity of the therapeutic effects experienced from BWRT, particularly in comparison to her previous experiences of CBT and Interpersonal Therapy, and consequently enquired about the possibility of further BWRT for other trauma related difficulties/ memories.

3.2.6 Participant six.

Participant six demonstrated reliable and clinically significant improvement on the IES-6 and both the anxiety and depression subscales of the HADS. Reliable change was noted on the MCS; however, a reliable and clinically significant deterioration was found on the PCS at the one- and two-month follow-ups due to a change in health status. The graphed IES-6 data shows a notably variable baseline; however, the magnitude of change between baseline and follow-up phases (i.e., 14-point change) is greater than two adjacent points in the baseline (i.e., 10-point change), and therefore, arguably demonstrates a clear intervention effect. In addition, graphical depiction of the

follow-up data shows minimal variability and stability of effects, which were also largely replicated in the HADS-4 data display. The effect size estimations (1.0) for both measures suggest maximal effectiveness of the intervention.

In-session process measures decreased as predicted, demonstrating by proxy, a reduction in vividness and emotionality of the target trauma memory. Alike previous findings this was accompanied by therapeutic increases in R-MSSD and HF, and respective decreases in HR. Participant six experienced the largest HRV increase pre-to-post-intervention; however, this was incongruent with her self-reported deterioration in physical health, when interpreting HRV as a marker of global health. Yet, participant six had also commented on her increased ability to manage stressful situations (i.e., responding to a car crash); with such adaptive coping also be considered an indicator of HRV. Participant six understood her ongoing management of ME as being distinct to her experience of trauma-related difficulties and, therefore, the apparent discrepancy between self-report and physiological data may reflect an extreme response bias.

Participant six described her experience of BWRT as ‘positive’ yet made familiar comments regarding the concentration demands placed upon her during the therapeutic process. In addition, participant six made reference to the therapists change in tone and pace of speech, having initially found this ‘distracting’ and somewhat ‘weird’, and felt some ‘pre-warning’ of this unusual part of therapy would have been helpful. However, participant six did not consider the therapist’s change in speech a negative or iatrogenic effect and reported finding it easier to follow when she was able ‘let go’ and just hear the therapist, rather than attempting to listen to every word. Having experienced previous CBT and EMDR therapy for her presenting trauma, participant six was impressed at the immediacy of improvement she experienced, and comparative to EMDR, considered BWRT an approach that ‘...gets a job done, but in a respectful way’, relative to the ‘softly, softly approach’ of EMDR. Similarly, to previous participant’s phenomenological experiences, participant six described her trauma memory as no longer eliciting upset and having faded, losing olfactory and auditory detail that had previously been very clear. This had been maintained when encountering potentially triggering situations, and participant six reported being surprised at how different she had responded in these scenarios (e.g., feeling relaxed and at ease with her sons return to school after the summer holidays). Aligned with the

explicit responses of participants three, four, and five; participant six described a broader level change on her thinking, reporting this as more ‘rationale’ which allowed her to be ‘calmer’ when managing everyday stressors. In addition to, an improved relationship with her son as she experienced less separation anxiety and less fears regarding his safety, which had resulted in both parties being ‘happier’.

4. Discussion

4.1 Treatment effectiveness.

Taken together, the repeated measurement strategy, two-month follow-up period, replication of effects and the qualitative commentary offered by participant’s, means we can be reasonably confident that the treatment was responsible for the therapeutic gains reported. The rapidity with which treatment took effect on trauma symptomatology was immediate for five of the six participants. One week elapsed before the effect of the intervention could be studied; arguably this left the treatment effect open to the influence of other variables; yet, the five participants that displayed clinically important change attributed this fully to the therapy. Also, due to the longstanding nature of the participant’s difficulties it is unlikely that maturation effects in the guise of spontaneous remission are responsible for detected changes. Neither do pantheoretical factors, such as the therapeutic alliance or therapist skillfulness, appear an important contributor to outcome, given the intervention was delivered in a single session affording minimal therapist contact⁵³, and is highly manualised minimising the effect of therapist factors regarding competency.

Furthermore, the literature on expectancy effects suggest that expectations that are naturally occurring pre-therapy, and those that have been induced by providing clients with specific information prior to therapy can be important contributors to treatment outcome (Tambling, 2012). To limit the possibility of inflated expectation effects, participants were given limited information about BWRT at the screening and treatment session. Additionally, it is unlikely that expectation effects alone would result

⁵³ Of note, while participants had prior service contact, they had not had any contact with the treating therapists prior to their BWRT session.

in long-lasting symptom reduction and behavioural change as observed at the two-month follow-up. The replication of these effects across participants offers external validity; however, claims of effectiveness cannot be made beyond the non-complex trauma population. Yet, the ecological validity offered by the naturalistic design used would suggest these findings could be replicated with different therapists and across different settings.

4.2 Findings in the Context of Previous Research and Theory.

The models reviewed have largely centered on concepts of memory networks, each model guiding the practice of their proposed treatment and positing different agents of change. The findings from the BWRT intervention are considered within the framework of these pre-existing trauma theories and treatment.

4.2.1 Exposure and Habituation.

The EPM (Foa & McNally, 1996) combined the concept of habituation with the concept of corrective learning to elucidate the effects of exposure therapy; with a particular emphasis on within-session fear reduction as a critical index of therapeutic change. Study findings demonstrated within-session habituation on self-reported arousal/ emotionality ratings elicited by the trauma memory and on the physiological indices, offering some coherence between measures. Yet, heartrate remained constant throughout, only showing notable reductions at the end of the session which is oppositional to the gradual decline expected, particularly in imaginal exposure (Blakey & Abramowitz, 2016; Thayer et al., 2000). Due to differing temporal points of data collection, it is unknown whether the arousal and emotionality ratings would have shown reductions prior to the recursive looping or followed a similar pattern to heartrate recordings. The heartrate finding may be partly explained by the extent of cognitive loading placed on participants, with unanimous reports describing BWRT as an effortful process, demanding both cognitive and physical resources which may maintain autonomic arousal. Some research suggests increasing cognitive load linearly reduces anxiety (Vytal, Cornwell, Arkin, & Grillon, 2012); yet, this may be indicative of too much loading that prohibits engagement with, and processing of, the feared stimulus, if recipients become too focused on task performance. Moreover, this is also mediated by the level of state anxiety. Foa et al. (2006) introduced a caveat into the EPM,

suggesting that when fear exceeds the optimum level for emotional processing to take place, distraction may titrate it, thereby enhancing outcome. Yet, even with these attentional caveats there is a prevailing notion that treatment efficacy relies on extended sessions, and the occurrence of habituation between sessions as also important for successful outcome (Jaycox et al., 1998), which is in contrast with the findings of this study.

Counter-theories such as the inhibitory learning theory (ILT; Craske et al., 2008) have arisen in response to the inconsistencies posed by the EPM. ILT suggests that the duration of exposure need only be long enough to violate the expectancies of the unconditioned stimulus (i.e., feared consequences) in order for new learning to take place (Craske et al., 2008). Yet, there remains an expectation that the duration of exposure is as long or longer than the fear cue they encountered during acquisition to maximise extinction performance (Gallistel & Gibbon, 2000). Although this theory offers some explanation of findings that demonstrate successful response to exposure in the absence of habituation (Meuret, Seidel, Rosenfield, Hofmann, & Rosenfield, 2012; Tsao & Craske, 2000); it fails to account for the rapidity of improvement found in the current study. BWRT appears able to achieve its therapeutic effects with seemingly less exposure to the trauma with consideration to traditional exposure therapies, with only in-session treatment, whilst also incorporating elements of divided attention manipulation. From this, BWRT appears more like the novel therapy it professes to be, as opposed to a 're-engineering' of existing exposure therapies; a remark also often directed at EMDR therapy.

Additionally, the process of cognitive appraisal is considered a key agent of change by the EPM and cognitivism, through augmenting or reducing feelings of affect and its physiological correlates (Jackson, Malmstadt, Larson, & Davidson, 2000). This involves volitionally reinterpreting the meaning of a trauma memory using higher cortical centers (Steinberger, Payne, & Kensinger, 2011). The founder of BWRT makes the claim that therapists are working directly with unconsciousness while the client remains in a waking state; however, the nature of this is difficult to determine. What we can infer thus far, is that having the client manipulate the memory through imagery appears to have beneficial effects. Moreover, reappraisal appears to occur only after the *recursive looping* during stage 13 (see journal paper Table 4 for stage descriptions).

Here, clients are asked to ‘fire up’ their original arousal response and are often unable to, providing live feedback to their challenge appraisals of their memory as threatening. This was exemplified via participants qualitative descriptions of being unable to replicate their same response at the end of the session, and the ‘elation’ and ‘confusion’ this created for them regarding how quickly they felt different. Consequently, such changes in appraisal and perception appear to be a by-product of processing, not an agent of change.

4.2.2 Dual Taxation of Working Memory.

Dual taxation in EMDR therapy is considered a key curative factor leading to positive treatment effects (van den Hout & Engelhard, 2012); and has a substantial body of literature to support such claims (Andrade et al., 1997; Gunter & Bodner, 2008; Lee & Cuijpers, 2013). Although it would be spurious to make such claims of BWRT, it would not be unfounded to suggest that procedural elements in BWRT are akin to dual taxation, and that this dual taxation may contribute to therapeutic outcome. The findings in the current study are consistent with the predictions of the working memory account; namely reduced vividness and emotional tone of the target trauma memory following dual taxation (*recursive looping*), evidencing ‘imagination deflation’ (van den Hout & Engelhard, 2012). In addition to, supportive qualitative reports from participants’ offering unbeknown descriptions of dual taxation and attentional switching between memories as instructed by the therapist: ‘I was thinking of going back and then my mind was shooting forward’- ‘I was listening and going from one to the other’. As the results suggest, this process is considered to alter the saliency of the original memory whereas extinction processes are believed to produce a new competing memory or inhibitory association that suppresses the conditioned response (i.e., avoidance). The spontaneous recovery phenomenon further indicates that extinction does not sever the original fear association (McNally, 2007; Foa, 1979), which translates to notable rates of relapse following exposure therapy (Blakey & Abramowitz, 2016; Craske et al., 2008), where clients regress, at least partially to their fearful responses (Mystkowski, Craske, & Echiverri, 2002).

The apparent relationship between dual taxation of the working memory, and the memory-effect has the form of an inverted U: not sufficiently taxing the working

memory or overly taxing it during memory recall, has little or no effect (Engelhard et al., 2011; van den Hout & Engelhard, 2012). However, there are individual differences in working memory capacity and therefore, some individuals are likely to benefit a lot or very little from dual task procedures. The level of cognitive loading elicited is considered to be dependent on the complexity and duration of the dual task procedure (van Veen et al., 2015; van Veen, Engelhard, & van den Hout, 2016). The lack of progress demonstrated by participant one could be hypothesised as a mismatch between working memory capacity and the level of dual taxation used. Participant one described difficulty holding the dual focus: ‘Too much, my mind couldn’t keep up’, and in particular during the *recursive looping* where there were no breaks in between the eight loops/ activation phases: ‘I tried to ignore the fast talking... I thought please slow down’. Despite within-session ratings indicating reduced vividness and emotional value, at the one-month follow-up participant one was unable to provide details on how the quality of her memory had changed, unlike her counterparts⁵⁴. If understood from the perspective of working memory capacity, these results are consistent with other findings. For example, people with low working memory are more distracted by eye movements and therefore, achieve greater benefits, as evidenced by a larger delay during response tasks and a greater reduction in memory vividness and emotionality (Gunter & Bodner, 2008; van den Hout et al., 2010). However, when the complexity of dual tasks increases (e.g., complex arithmetic) the memory remains largely unchanged (Engelhard et al., 2011). Unlike passive listening (e.g., alternating beeps) that is deemed less effective (van den Hout et al., 2011a); in BWRT, the participant attempts to actively listen to the instructive script spoken at increasing pace by the therapist, and concurrently switch between their memories accordingly (*recursive looping*). Arguably this is a complex and long-lasting (approx. 90- 120s) dual taxation procedure. For those clients with low working memory capacity, it raises the question whether the degree of working memory taxation could be adapted in BWRT. For example, reducing the pace of the therapist’s speech if the client reported difficulty recalling their memory, or

⁵⁴ Here, the temporary effect experienced by participant one is aligned with previous research that used brief exposure and dual taxation sets (8 x 8s) and found transient changes in memory quality immediately following the procedures (Lilley, Andrade, Turpin, Sabin-Farell, & Holmes, 2005). The authors concluded that even very brief dual taxation procedures can disrupt active maintenance and manipulation of traumatic images, but for durability of effects longer sets are required.

alternatively increasing pace and taxing if the image remained too vivid; similar to a quickening or slowing down of eye movements in EMDR as required (van den Hout & Engelhard, 2012). Yet a caveat here that researchers and therapists alike need to be aware of, is that participants and clients respectively may preference tasks they experience as less taxing or requiring only passive attention, despite these tasks eliciting less clinical improvement (van den Hout et al., 2011a). Therefore, participant or client satisfaction should not be prematurely mistaken for effectiveness without further investigation of its effects.

4.2.2.1 BWRT and EMDR.

Topographically, BWRT and EMDR appear to share a number of procedural elements. Unlike exposure-related therapies, both EMDR and BWRT do not require the client to revisit and describe their trauma memory in detail; insofar as this is actively discouraged in BWRT. BWRT is considered a ‘contentless’ therapy, whereby clients are encouraged to have their eyes closed for the majority of the therapeutic process to remove visual input that is considered to interfere with the development of new neural pathways. For the same reason reciprocal dialogue between client and therapist is avoided where possible, to circumvent clients becoming preoccupied with therapist’s reactions to self-disclosures made (Watts & Lockhat, 2017). This aspect of BWRT was seemingly valued by participants, who considered the discouragement of self-disclosure advantageous.

Neither EMDR nor BWRT utilise in-between session tasks to consolidate treatment gains (Wesson & Gould, 2009), unlike TF-CBT which encourages this (e.g., clients listening to audio recordings of their trauma recall between sessions). For this reason, it has been suggested that EMDR could achieve positive treatment effects utilising consecutive day treatment (Oren & Solomon, 2012). Principally, this would also apply to BWRT; however, practice-based evidence has demonstrated that trauma resolution can often be reached in a single session, which has been supported by current findings. EMDR also has the capability to achieve such effects within a single session, demonstrated with spider-phobia (Muris, Merckelbach, van Haaften, & Mayer, 1997), single event trauma (Aubert-Khalifa, Roques, & Blin, 2008; Rogers et al., 1999), test anxiety (Maxfield & Melnyk, 2000), and acute stress syndrome (Kutz, Resnik, &

Dekel, 2008); yet, all of these studies contend with methodological limitations, such as sample size, inadequate measurement, and a lack of follow-up to determine the long-term efficacy of single session treatment. This is a similar unknown of BWRT, with only anecdotal reports proffering the long-term efficacy of the therapy.

Both therapies use in-session self-report measures of arousal as a guide to processing, with particular thresholds indicating when processing is complete, and when further activation is required. As discussed above dual taxation procedures appear to be a key mechanism that facilitates the processing of troublesome memories in both therapies. In addition, a strategy of both is the encouragement of the client to create a new memory with imagined adaptive behaviours to serve as a memory template for future functioning (Oren & Solomon, 2012; Watts & Lockhat, 2017). Alongside this is the shared ability to process negative images of future events, termed ‘flashforwards’ (Engelhard et al., 2010b); although not as yet subject to empirical scrutiny in BWRT.

Both therapies are underpinned by internal theories that make conjectures regarding the configuration of memory networks and neuronal pathways, and their interactions with various brain structures (Solomon & Shapiro, 2008; Watts, 2014). The proposed neurobiological changes of both therapies are unobservable and, therefore, largely unfalsifiable; making it difficult to discern whether the therapy works for the reasons given in the theoretical rationale. Yet, arguably the neurophysiological basis of any form of therapy is relatively unknown. It is clear, that answers to the questions surrounding EMDR and BWRT (as with other therapies) lie within the brain, and theory development largely relies on psychotherapy and brain research developing in parallel (Pagani et al., 2007; Richardson et al., 2009). Yet, mechanisms through which treatments operate can be gleaned from studying psychological and psychophysiological processes, using multiple types of evidence to identify areas of convergence (Kazdin, 2008). Importantly, a treatment might work for multiple reasons and these reasons may be shared between therapies; for example, as the findings suggest BWRT may have harnessed a key factor (dual taxation) that influences outcome in EMDR, yet, notably this is limited to by-proxy measurement of internal processes.

The early clinical claims and proposed explanations of EMDR therapy were met with scepticism, (Solomon & Shapiro, 2008) and despite now reaching evidence base status and being endorsed by a number of national guidelines (American Psychiatric

Association, 2004; Ursano et al., 2004; Australian Centre for Post-traumatic Mental Health, 2007; NICE, 2005), questions still remain regarding how EMDR actually works (van Veen et al., 2015). It is anticipated that BWRT will follow a similar trajectory and encounter its share of controversy when introduced to the scientific community.

4.2.3 Polyvagal theory.

The broader level changes experienced by participants, namely better coping and improved relationships are largely coherent with the recorded changes in HRV (except for two participants), when considered within the context of polyvagal theory (Porges, 2007) whereby behavioural improvement is also considered to manifest in autonomic measures. Four participants demonstrated increased HRV from pre- to post-intervention, indicating dominance of the parasympathetic response and higher vagal tone. Research has found a positive relationship between vagal tone and perceptions of social support (Schwerdtfeger & Schlagert, 2011), evidencing more active social engagement to manage distress and an increase in approach behaviour when tackling stressors (Geisler et al., 2013). Notably, despite the discrepancy in treatment effects between participant one and her counterparts, participant one still demonstrated a small increase in HRV at post-intervention which is comparable to the marginal clinical improvement on the IES-6 and qualitative comments describing her trauma memory as 'less frequent and intense', offering a degree of cross-validation and triangulation across of findings.

Importantly, there are numerous factors that can influence HRV, on a specific moment-to-moment level and on a broader level. Respectively, actions such as talking, repositioning in a chair, changing breathing rate, can trigger small changes in HR and reflective HRV (Nunan, et al., 2010). On a more general level, factors such as alcohol and caffeine intake, sleep quality, in addition to physical and mental stress can similarly effect HR and HRV (McCraty, Atkinson, Tiller, Rein, & Watkins, 1995; Nunan et al., 2010). It can be reasonably considered that all participants were experiencing mental and physical stress given the fact they were recruited from the Physical health service and had also chosen to access trauma therapy. Many of these other factors were beyond the control of the study given this study was situated in 'real-world' practice.

4.3 Experience of BWRT.

The qualitative component of this study afforded data regarding participant's experiences of the processes in BWRT and the immediate and accumulative outcomes achieved (see journal paper for further results and discussion). Regarding insight into BWRT processes, the one stage clearly demarcated by participants was the *recursive looping*. Participants appeared to find this particular stage most effortful and demanding, yet, only one considered this a negative phenomenon. Towards the end of the looping four participants spoke of feelings of relaxation and calmness being elicited, and described an immediate change in their trauma memory, with the memory becoming less vivid, harder to visualise, and triggering less emotion which was also reflected in participants within-session ratings. This finding is consistent with qualitative experiences of participants in EMDR therapy describing similar phenomenological changes (Brotherton, 2009; Cotter, Meysner, & Lee, 2017). Of note, participants also reported positive shifts in other areas not specifically targeted in the therapy, for example, improved self-confidence, more rational thinking, and better relationships with others.

4.4 Research strengths.

Firstly, subjecting BWRT, a therapy with no published evidence base, to controlled research parameters was considered a notable strength in and of itself. In addition, participants completed the study procedures with no adverse effects⁵⁵ or attrition; suggesting the researched technique was sufficiently sensitive, safe, and well accepted. The psychosomatic method, using both physiological and psychological measurement enabled a more comprehensive evaluation of participants' response to treatment, particularly given BWRT is a 'contentless' therapy and participants are largely silent recipients of the therapy. Importantly, unobtrusive recording measures for HR and HRV were implemented to avoid interfering with or compromising treatment fidelity. Moreover, one- and two-month follow-ups allowed some investigation regarding the longevity of treatment effects, which afforded knowledge of the more

⁵⁵ Participant five considered her experience of psychosis and subsequent hospital admission to be triggered by factors external to the study procedures and BWRT therapy.

accumulative changes that occurred for participants post-therapy, and the lived experience of participants undertaking of BWRT. Lastly, a robust analysis of the findings was undertaken in keeping with the methodology used and study aims/hypotheses. Statistical scrutiny other than that conducted was considered to be superfluous, as the visual analysis of participant's graphs was demonstrably conclusive.

4.5 Research Limitations.

Although the incorporation of physiological measurement is advantageous for reasons discussed, HRV does elicit high inter- and intra-individuality (Fohr et al., 2015). Therefore, measurement across multiple physiological systems would have provided more robust evidence for the reported patterns of reduction (or lack thereof) in physiological arousal. For example, skin conductance is influenced solely by sympathetic inputs (Boucsein, 2012) often associated with anxiety disorders (Wang et al., 2016); therefore, having a measure of the sympathetic and parasympathetic branches (HRV indices) of the autonomic nervous system would have provided a more comprehensive measurement of participants' physiological responses to therapy. One would expect skin conductance to reduce concurrently, as HRV indices (R-MSSD and HF) increase, given the antagonistic relationship between parasympathetic and sympathetic systems.

In this study the baseline period was partly decided by how quickly a therapist became available and was organised in advance of assessing the stability of baseline data. Stability of baseline data is encouraged to enable more confident conclusions regarding the effect of the independent variable, and to delineate this from the effects of extra-therapeutic factors, maturation, or measurement error (Barlow et al., 2008). Yet, preventing a participant from accessing therapy until baseline stability was achieved was considered unacceptable. However, this was mediated slightly in that a two-week baseline was mandatory to achieve the 3-4 data points required prior to the intervention (Morley, 2018), however, in the end most participant's baseline was longer than this due to therapist availability. For the same pragmatic reasons, systemic staggering of the intervention across participants was also not feasible and therefore, some participants were introduced to the intervention on consecutive days, whilst others were separated

by 3 or more weeks. Arguably, this still satisfied the multiple baseline design criterion to demonstrate change within the treated person and not others within the study without the requirement that treatment should be reversed (Morley, 2018); however, systematically separating the introduction of treatment between participants (e.g., 7 days between participants) could have enhanced the robustness of the study.

In addition, it is unclear whether the combined effects of treatment as usual followed by BWRT had any bearing on the findings; however, it is important to acknowledge that the recruited participants were a self-selecting sample who may have been motivated to maintain engagement with the service, and who given their previous contact with the service were potentially more accepting of a psychological explanation of their difficulties and therefore, were more agreeable to the BWRT process.

4.6 Clinical Implications and Future Research.

BWRT is a nascent therapy at the early stage of the research cycle, with this study seemingly being the first to open routine practice of BWRT to scientific scrutiny. The study itself was designed as such, so participants could be treated under conditions relatively close to standard practice to aid the ecological validity of findings. Five of the six recruited participants demonstrated meaningful positive change captured across the majority of the different methods of measurement, with four demonstrating clinically significant change on trauma symptomology. Whilst this is a clinically valuable result, it is important neither to over- nor understate the likely benefits of BWRT given the sample size and lack of supporting controlled research with which to contextualise the current findings. Conversely, the dosage-effect relationship found suggests clients struggling with distress associated with non-complex trauma could experience resolution of their difficulties within a single session, which is an attractive prospect for clients and NHS services alike, given the economic pressures within healthcare-systems. The planning and provision of psychological therapy services is very much based on research evidence and therefore, for BWRT to be commissioned and integrated in wider service provision research is unequivocally needed.

The unvalidated status of BWRT reflects the inevitable lag between practice and research (Roth & Parry, 1997), and in doing so creates a host of research opportunities.

Aligned with the ‘hourglass’ model pertaining to novel therapies (Salkovskis, 1995), BWRT would benefit from further investigation through the evaluation of case series, and if results are continually promising, RCTs can then be undertaken to determine whether or not BWRT is indeed efficacious. Given BWRT is a highly manualised therapy, it would lend itself well to RCTs. This can then be followed by larger scale field trials situated in everyday practice to evaluate the clinical effectiveness of BWRT.

Alongside efficacy research, investigations regarding therapy processes are needed to optimise the generality of treatment effects from research to practice and discern what components may be mutative and what components (in relation to outcome) may be redundant. Although, dual taxation appears a likely candidate as a key mechanism of change, component analysis is needed to identify the relative contribution of dual taxation, if at all, in BWRT. Importantly it remains uncertain whether a reduction in memory image vividness is even related to direct changes caused by the effects of dual taxation on working memory, if in fact the WM is being taxed. Therefore, creative approaches are needed to assess this, whilst accepting psychological measurement can only measure by-proxy and offer inferences pertaining to process. To determine the effects of working memory capacity on outcome, pre-assessment of participants’ working memory capacity could be undertaken, and adaptations of the dual task procedure trialed to make this more, or less complex. For example, this could involve reducing the pace and volume of the therapist’s speech during the *recursive looping* stage for participants with low working memory capacity. This may partially answer questions regarding the applicability of BWRT to clients who have neurodevelopmental disorders or acquired brain injuries where working memory is compromised. Similarly, dismantling studies that remove specific stages of the protocol, or that study individual components in isolation or in combination with other components of the intervention could be helpful to identify the relative utility of the various components regarding therapeutic outcome.

In addition, further trajectories of investigation could involve comparative studies examining both EMDR and BWRT, alongside other trauma recommended therapies. As well as comparisons of effectiveness, this may also involve comparisons of speed, ease of application, attrition rates, comfort for client and safety. Such factors

are considered to direct service, clinician, and client level choice particularly when treatments are found to have comparable efficacy (Rogers et al., 1999).

5. Personal Reflections

Here I offer my personal reflections of the research process, including the reasons for selecting this research project, the strengths of the research and the challenges posed, and the areas of learning and development it has afforded me.

Admittedly the opportunity to study BWRT was somewhat a stroke of luck. My original research proposal which centred on the investigation of EMDR for depression, was curtailed after encountering recruitment difficulties. This was largely due to IAPT services being reticent to offer EMDR for mental health difficulties not explicitly recommended by NICE, and step 4 services for having two year waiting lists, and rightly being unable to privilege eligible participants for therapy to accommodate my research deadlines. Subsequently, I was introduced to BWRT by my research supervisor which immediately stimulated my interest and led me to pursue further consultation with the Physical Health Service whom I knew was utilising BWRT as part of routine practice. Needless to say, I was both enamoured by the anecdotal reports regarding the rapidity of therapeutic effects proposed and perplexed by the proposed theoretical underpinnings and processes used to explain what, and how BWRT works. The reported capability of BWRT to provide resolution of mild-moderate mental health difficulties in a single session was an exciting prospect, particularly given the current wider context of austerity in the NHS and ever-increasing prevalence of mental ill health. I considered it an unethical decision if I had not subjected this therapy to controlled research parameters, given I knew of its existence unlike many clinical psychologists I had approached, and the possibility of BWRT causing negative or iatrogenic effects for recipients, in addition to having the available means and funding to undertake such timely research.

The population of interest for the study were clients experiencing non-complex trauma, this decision was motivated by several factors. Firstly, I have a professional interest in trauma phenomenology having worked with traumatised clients across the

life span and intellectual functioning range, I was motivated to promote the dimensional experience of traumatic stress both in terms of severity (i.e., mild to severe) and aetiology (e.g., traumatic birth, childhood bullying). Secondly, with the ever-increasing worldwide prevalence of trauma, there is an unwavering need to better understand trauma processes for the sake of prevention as well as effective treatment.

During the developmental stage of my research I became acquainted with the SCED approach. The SCED offered an opportunity to demonstrate the effects of treatment with minimal resources and accommodate the investigation of treatment mechanisms which is of value when studying novel treatments. In addition, the SCED principles appeared congruent with the scientist-practitioner model, given the methodology affords the combining of research and practice whether being used to evaluate personal effectiveness as a Clinical Psychologist (practitioner) or the effectiveness of an intervention across cases for research (scientist). For my research I considered the SCED approach an ideal fit to answer the research questions I had posed, whilst also placing value on learning and developing my skills as a SCED researcher to produce meaningful research beyond training and monitor the effectiveness of my own practice once qualified.

The characteristic of SCED research is the repeated measurement of the process and outcome variable(s) of interest. To confidently infer that change was due to therapy and not extra-therapeutic factors the measurement strategy prior to, and during treatment required careful consideration. Alongside this, thought was also given to participant fatigue and burden, given participants also had co-morbid physical health conditions, namely CFS and ME. I think the measurement strategy that we ultimately decided on struck this balance well, affording a comprehensive assessment of process and outcome measurement. Although, the process measurement was not chosen to study the theoretical underpinnings of BWRT as this was not feasible within a naturalistic setting without compromising the fidelity of the therapy, therefore, process measures were designed to assess the hypothesised change mechanisms based on pre-existing theories of trauma (i.e., polyvagal theory) and EMDR change processes (i.e., WM hypothesis).

Additionally, given the administration of measures was largely conducted online, and I as the lead researcher was uninvolved in the delivery of treatment I think the potential influences of experimenter bias inflating treatment effects were negated. From my reading of published SCED research, such rigour is not always employed compromising the legitimacy of effects. Given my lack of involvement here, I decided to facilitate the change interviews as I did not consider my presence to elicit biased responding by participants, beyond that of any other interviewer. A study strength was the employment of three different therapists to facilitate the therapy, minimising possible therapist effects, in addition to each therapist not having met the participant before the treatment session, undermining any argument that treatment effects were a result of therapist alliance factors; given the intervention was completed in a single session. Treatment fidelity checks of all study therapists were undertaken to assess their competency and fidelity to the BWRT treatment protocol, providing an indication of construct validity. Again, I was surprised when reviewing the literature that fidelity checks are not always completed or not explicitly named as having been undertaken, and how this is not always acknowledged as a limitation of the study.

A further review of published SCEDs throughout the research process revealed an over-reliance on visual analysis alone, without due consideration given to estimations of effect size, or reliable or clinical change. Neither were alternative methods other than self-report incorporated into the measurement strategy. This was somewhat frustrating, given poor measurement and inadequate analysis contributes to a perception of SCED as a suboptimal research design in comparison to RCTs. However, if and when rigorous methodology is applied to SCEDs, then I believe SCEDs can also be held in high esteem alongside RCTs; given both research designs offer different perspectives on a treatment phenomenon. I used additional statistical analysis (RCI and effect size) and adopted a psychosomatic mixed method approach which I believe would constitute a rigorous research design. In addition, the measures used had good psychometric properties meaning the observed change was considered genuine and not attributable to unreliability, with the exception of the abbreviated HADS-4 designed for the study. The HADS-4 was created to minimise participant burden during the bi-weekly data collection at baseline but failed to retain the good psychometric properties of the full version.

Given I am a novice researcher I found the whole research process from conception to completion challenging for various reasons. Yet a key challenge for me personally was having to rely on the study therapists to facilitate BWRT faithfully, and to complete measurements correctly that are outside the realm of usual therapy. This related specifically to the HRV and audio recordings and the addition of the vividness rating during the therapy itself. I spent a significant time educating each therapist on how to utilise the HRV device and dictaphone and provided written instructions for them to consult. The risk was they would not use these devices correctly which would lead to missing data; yet, fortunately no such problems were encountered except for one missing vividness rating, although this did not notably affect the interpretation of results.

Furthermore, being the first person to subject BWRT to controlled research was both a great privilege, and a burden with regards to the level of responsibility I felt to get it right, not just for my own academic success but also for the wider BWRT community. I wanted to offer a critical investigation of BWRT, shining a light on the strengths, limitations, and unknowns of this approach. Yet, the therapy is constantly evolving, and the treatment protocol used in this study has since undergone revision, albeit only minor semantic changes to the *wait state* and *recursive looping* script. This is a challenge when researching emerging therapies during their developmental years, whereby researchers need to remain responsive to the changes and adaptations introduced. Moreover, nearing the end of my thesis I was given the opportunity to undertake the Level 1 BWRT training, at the time of writing this is still ongoing; however, it has been a helpful process to be involved in and given me some experiential insight into the deliverance of BWRT.

Although this project could not have been undertaken without considerable support from the co-authors, I believe I had several valuable ‘baseline’ skills that were particularly useful in the early stages of the research: namely, good communication skills and reflexivity to adapt my approach to my audience which meant I was able to effectively liaise and work alongside my research supervisors, NHS collaborators, and recruited participants. In addition to, a strong work ethic which was needed to maintain momentum and motivation to complete the project within a timely manner, without compromising the quality of my work. Throughout the research process my confidence

has built as I further developed my skills, particularly in data analysis and synthesis, which was a challenge given the substantial data set produced in this study. Yet, the enthusiastic participants who were also very much invested in the research process reinforced for me that research is both viable and important and can be undertaken directly with the clinical populations we work with. I hope my project will be a catalyst to stimulate further research on BWRT, it has certainly stimulated the researcher in me and given me enthusiasm to seek out further research opportunities to study this nascent, yet potentially worthwhile therapy.

Word count: 30, 819

Extended References

- Adshead, G. (2000). Psychological therapies for post-traumatic stress disorder. *The British Journal of Psychiatry: The Journal of Mental Science*, 177(2), 144-148.
doi:10.1192/bjp.177.2.144
- American Psychiatric Association. (1980). *Diagnostic and statistical manual of mental disorders* (3rd ed.). Washington, DC: Author.
- American Psychiatric Association. (2004). *Diagnostic and statistical manual of mental disorders* (4th ed.). Washington, DC: Author.
- American Psychiatric Association. (2013). *Diagnostic and statistical manual of mental disorders* (5th ed.). Washington, DC: Author.
- Andrade, J., Kavanagh, D., & Baddeley, A. (1997). Eye-movements and visual imagery: A working memory approach to the treatment of post-traumatic stress disorder. *British Journal of Clinical Psychology*, 36(2), 209-223.
doi:10.1111/j.2044-8260.1997.tb01408.x
- Angelo, F. N., Miller, H. E., Zoellner, L. A., & Feeny, N. C. (2008). "I Need to Talk About It": A Qualitative Analysis of Trauma-Exposed Women's Reasons for Treatment Choice. *Behavior Therapy*, 39(1), 13-21.
doi:10.1016/j.beth.2007.02.002
- Arnberg, F. K., Michel, P., & Johannesson, K. B. (2014). Properties of Swedish posttraumatic stress measures after a disaster. *Journal of Anxiety Disorders*, 28(4), 402-409. doi:10.1016/j.janxdis.2014.02.005

- Arnsten, A., Mazure, C. M., & Sinha, R. (2012). Neural circuits responsible for conscious self-control are highly vulnerable to even mild stress. When they shut down, primal impulses go unchecked and mental paralysis sets in. *Scientific America*, 306(4), 48-53.
- Aubert-Khalifa, S., Roques, J., & Blin, O. (2008). Evidence of a decrease in heart rate and skin conductance responses in PTSD patients after a single EMDR session. *Journal of EMDR Practice and Research*, 2, 51-56. doi:10.1891/1933-3196.2.1.51
- Austin, M. A., Riniolo, T. C., & Porges, S. W. (2007). Borderline personality disorder and emotion regulation: Insights from the polyvagal theory. *Brain & Cognition*, 65(1), 69-76. doi:10.1016/j.bandc.2006.05.007
- Australian Centre for Posttraumatic Mental Health (2007). *Australian Guidelines for the Treatment of Adults with Acute Stress Disorder and Posttraumatic Stress Disorder: Practitioner Guide*. Retrieved from https://www.nhmrc.gov.au/_files_nhmrc/publications/attachments/mh15.pdf%20
- Baddeley, A. (1998). Working memory. *Acadbmie des sciences*, 321(2-3), 167-173. doi:10.1016/S0764-4469(97)89817-4
- Baddeley, A. D., & Andrade, J. (2000). Working memory and the vividness of imagery. *Journal of Experimental Psychology General*, 129(1), 126-145. doi:10.1037/0096-3445.129.1.126.

- Baddeley, A. D., & Hitch, G. J. (1974). Working memory. In G. A. Bower (Eds.), *Recent Advances in Learning and Motivation* (Vol. 8, pp. 47-89). New York, NY: Academic Press.
- Barlow, D. H., Nock, M. K., & Hersen, M. (2008). *Single Case Experimental Designs: Strategies for Studying Behavior Change* (3rd ed.). Boston, MA: Pearson.
- Barrowcliff, A. L., Gray, N. S., Freeman, T. C. A., & MacCulloch, M. J. (2004). Eye-movements reduce the vividness, emotional valence and electrodermal arousal associated with negative autobiographical memories. *The Journal of Forensic Psychiatry and Psychology*, 15(2), 325-345.
doi:10.1080/14789940410001673042
- Beauchaine, T. P. (2001). Vagal tone, development, and Gray's motivational theory: Toward an integrated model of autonomic nervous system functioning in psychopathology. *Development and Psychopathology*, 13(2), 183-214.
doi:10.1017/S0954579401002012
- Beauchaine, T. P., Gatzke-Kopp, L., & Mead, H. K. (2007). Polyvagal theory and developmental psychopathology: Emotion dysregulation and conduct problems from preschool to adolescence. *Biological Psychology*, 74(2), 174-184.
doi:10.1016/j.biopsycho.2005.08.008
- Beauchaine, T. P., Katkin, E. S., Strassberg, Z., & Snarr, J. (2001). Disinhibitory psychopathology in male adolescents: Discriminating conduct disorder from attention-deficit/hyperactivity disorder through concurrent assessment of multiple autonomic states. *Journal of Abnormal Psychology*, 110(4), 610-624.
doi:10.1037/0021-843X.110.4.610

Beck, A. T. (1967). *Depression: Clinical, Experimental and Theoretical Aspects*. New York, NY: Harper and Row.

Becker, C. B., Zayfert, C., & Anderson, E. (2004). A survey of psychologists' attitudes towards and utilization of exposure therapy for PTSD. *Behaviour Research & Therapy*, 42, 277-292. doi: 10.1016/S0005-7967(03)00138-4

Becker, C., Darius, E., & Schaumberg, K. (2007). An analogue study of patient preferences for exposure versus alternative treatments for posttraumatic stress disorder. *Behaviour Research and Therapy*, 45(12), 2861-2873.
doi:10.1016/j.brat.2007.05.006

Biglan, A. (2004). Contextualism and the development of effective prevention practices. *Prevention Science*, 5(1), 15-21. doi:10.1023/B:PREV.00000013977.07261.5a

Bisson, J. I. (2009). Psychological and social theories of post-traumatic stress disorder. *Epidemiological, theoretical basis and management*, 8(8), 290-292.
doi:10.1016/j.mppsy.2009.05.003

Blakey, S. M., & Abramowitz, J. S. (2016). The effects of safety behaviors during exposure therapy for anxiety: Critical analysis from an inhibitory learning perspective. *Clinical Psychology Review*, 49, 1-5. doi:10.1016/j.cpr.2016.07.002

Borrelli, B. (2011). The assessment, monitoring, and enhancement of treatment fidelity in public health clinical trials. *Journal of Public Health Dentistry*, 71(1), 52-63.
doi:10.1111/j.1752-7325.2011.00233.x

- Boscarino, J. A., Adams, R. E., & Galea, S. (2006). Alcohol use in New York after the terrorist attacks: A study of the effects of psychological trauma on drinking behavior. *Addictive Behaviors*, 31(4), 606-621.
doi:10.1016/j.addbeh.2005.05.035
- Boucsein, W. (2012). *Electrodermal activity*. Berlin: Springer Science & Business Media.
- British Psychological Society. (2014). *BPS Code of Human Research Ethics*. Retrieved from <https://www.bps.org.uk/news-and-policy/bps-code-human-research-ethics-2nd-edition-2014>
- Breslau, N. (2002). Epidemiologic studies of trauma, posttraumatic stress disorder, and other psychiatric disorders. *Canadian Journal of Psychiatry*, 47(10), 923-932.
doi:10.1177/070674370204701003
- Breslau, N., Lucia, V. C., & Davis, G. C. (2004). Partial PTSD versus full PTSD: An empirical examination of associated impairment. *Psychological Medicine*, 34(7), 1205-1214. doi:10.1017/S0033291704002594
- Brewin, C. R. (2006). Understanding cognitive behaviour therapy: A retrieval competition account. *Behaviour Research and Therapy*, 44(6), 765-84.
doi:10.1016/j.brat.2006.02.005
- Brewin, C. R., & Holmes, E. A. (2003). Psychological theories of posttraumatic stress disorder. *Clinical Psychology Review*, 23(3), 339-376. doi:10.1016/S0272-7358(03)00033-3

- Brewin, C. R., Andrews, B., & Valentine, J. D. (2000). Meta-analysis of risk factors for posttraumatic stress disorder in trauma-exposed adults. *Journal of Consulting and Clinical Psychology*, 68(5), 748-766. doi:10.1037/0022006X.68.5.748
- Brewin, C. R., Rose, S., Andrews, B., Green, J., Tata, P., McEvedy, C., ... Foa, E. B. (2002). Brief screening instrument for post-traumatic stress disorder. *British Journal of Psychiatry*, 181(8), 158-162. doi:10.1192/bjp.181.2.158
- Broman-Fulks, J. J., Ruggiero, K. J., Green, B. A., Kilpatrick, D. G., Danielson, C. K., Resnick, H. S., ... Saunders, B. E. (2006). Taxometric Investigation of PTSD: Data from two nationally representative samples. *Behavior Therapy*, 37(4), 364-380. doi:10.1016/j.beth.2006.02.006
- Brotherton, N. (2009). *Eye Movement Desensitisation and Reprocessing (EMDR) for trauma: A qualitative analysis of clients' experiences*. (Unpublished doctoral dissertation). University of Lincoln, Lincoln.
- Cahill, S. P., Rothbaum, B. O., Resick, P. A., & Follette, V. M. (2009). Cognitive-behavioral therapy for adults. In E. B. Foa & T. M. Keane, M. J. Friedman, & Cohen, J. A. (Eds.), *Effective treatments for PTSD: Practice guidelines from the International Society for Traumatic Stress Studies* (pp. 139-222). New York, NY: Guilford Press.
- Chang, H., Chang, C., Tzeng, N., Kuo, T. B., Lu, R., & Huang, S. (2013). Decreased cardiac vagal control in drug-naïve patients with posttraumatic stress disorder. *Psychiatry Investigation*, 10(2), 121-130. doi:10.4306/pi.2013.10.2.121

- Charuvastra, A., & Cloitre, M. (2008). Social bonds and posttraumatic stress disorder. *Annual Review of Psychology*, 59(1), 301-328.
doi:10.1146/annurev.psych.58.110405.085650
- Chemtob, C., Roitblat, H., Hamada, R. S., Carlson, J. G., & Twentyman, C. T. (1988). A cognitive action theory of post-traumatic stress disorder. *Journal of Anxiety Disorders*, 2(3), 253-275. doi:10.1016/0887-6185(88)90006-0
- Christiansen, D. M., & Hansen, M. (2015). Accounting for sex differences in PTSD: A multi-variable mediation model. *European Journal of Psychotraumatology*, 6, 1-10. doi:10.3402/ejpt.v6.26068
- Cochran, B. N., Pruitt, L., Zoellner, S. F. L. A., & Feeny, N. C. (2008). Reasons Underlying Treatment Preference: An Exploratory Study. *Journal of Interpersonal Violence*, 23(2), 276-291. doi: 10.1177/0886260507309836
- Cohen, H., Neumann, L., Shore, M., Amir, M., Cassuto, Y., & Buskila, D. (2000). Autonomic dysfunction in patients with fibromyalgia: Application of power spectral analysis of heart rate variability. *Seminars in Arthritis and Rheumatism*, 29(4) 217-227. doi:10.1016/S0049-0172(00)80010-4
- Collerton, D. (2013). Psychotherapy and brain plasticity. *Frontiers in Psychology*, 4(548), 1-5. doi:10.3389/fpsyg.2013.00548
- Cook, J. M., Schnurr, P. P., & Foa, E. B. (2004). Bridging the gap between posttraumatic stress disorder research and clinical practice: The example of exposure therapy. *Psychotherapy: Theory, Research, Practice, Training*, 41(4), 374-387. doi:10.1037/0033-3204.41.4.374

- Cooper, J. O., Heron, T. E., & Heward, W. L. (2007). *Applied behavior analysis* (2nd ed.). Upper Saddle River, NJ: Pearson Prentice Hall.
- Cosco, T. D., Doyle, F., Ward, M., & McGee, H. (2012). Latent structure of the Hospital Anxiety and Depression Scale: a 10-year systematic review. *Journal of Psychosomatic Research*, 72(3), 180-184. doi: 10.1016/j.jpsychores.2011.06.008.
- Cotter, P., Meysner, L., & Lee, C. W. (2017). Participant experiences of Eye Movement Desensitisation and Reprocessing vs. Cognitive Behavioural Therapy for grief: similarities and differences. *European Journal of Psychotraumatology*, 8(1), 1-10. doi:10.1080/20008198.2017.1375838
- Craske, M. G. (1999). *Anxiety disorders: Psychological approaches to theory and treatment*. Boulder, CO: Westview.
- Craske, M. G., Street, L., & Barlow, D. H. (1989). Instructions to focus upon or distract from internal cues during exposure treatment of agoraphobic avoidance. *Behaviour Research and Therapy*, 27, 633-672. doi:10.1016/0005-7967(89)90150-2
- Craske, M., Kircanski, K., Zelikowsky, M., Mystkowski, J., Chowdhury, N., & Baker, A. (2008). Optimizing inhibitory learning during exposure therapy. *Behaviour Research and Therapy*, 46(1), 5-27. doi:10.1016/j.brat.2007.10.003
- Creswell, J. W., & Plano-Clark, V. L. (2011). *Designing and conducting mixed methods research* (2nd ed.). London: Sage.
- Creswell, J., & Plano-Clark, V. (2007). *Designing and Conducting Mixed Methods Research*. Thousand Oaks, CA: Sage.

- Crowell, S. E., Beauchaine, T. P., McCauley, E., Smith, C. J., Stevens, A. L., & Sylvers, P. (2005). Psychological, autonomic, and serotonergic correlates of parasuicide among adolescent girls. *Developmental Psychopathology*, 14(4), 1105-1127.
doi:10.1017/S0954579405050522
- Cukor, J., Spitalnick, J., Difede, J., Rizzo, A., & Rothbaum, B. O. (2009). Emerging treatments for PTSD. *Clinical Psychology Review*, 29(8), 715-726.
doi:10.1016/j.cpr.2009.09.001.
- Cukor, J., Wyka, K., Jayasinghe, N., & Difede, J. (2010). The nature and course of subthreshold PTSD. *Journal of Anxiety Disorders*, 24, 918-923.
doi:10.1016/j.janxdis.2010.06.017
- Cvetek, R. (2008). EMDR treatment of distressful experiences that fail to meet the criteria for PTSD. *Journal of EMDR Practice and Research*, 2, 2-14.
doi:10.1891/1933-3196.2.1.2
- Dadić-Hero, E., Torić, I., Ružić, K., Medved, P., & Graovac, M. (2009). Comorbidity-A troublesome factor in PTSD treatment. *Psychiatria Danubina*, 21(3), 420-424.
- Dalgleish, T. (2004). Timeline: The emotional brain. Nature Reviews. *Neuroscience*, 5(7), 582-589. doi:10.1038/nrn1432
- Damasio, A. (1994). *Descarte's Error: Emotion, Reason, and the Human Brain*. New York, NY: Gosset/Putnam.
- Data Protection Act. (1998). *Section 33(2)*. Retrieved from
www.uklegislation.hmso.gov.uk/acts/acts1998/19980029.htm

- Davidson, J. R., Stein, D. J., Shalev, A. Y., & Yehuda, R. (2004). Posttraumatic stress disorder: acquisition, recognition, course, and treatment. *Journal of Neuropsychiatry and Clinical Neurosciences*, 16(2), 135-147.
doi:10.1176/jnp.16.2.135
- De Smedt, D., Clays, E., Annemans, L., Doyle, F., Kotseva, K., Pajak, A., ...De Bacquer, D. (2013). Health related quality of life in coronary patients and its association with their cardiovascular risk profile: results from the EUROASPIRE III survey. *International Journal of Cardiology*, 168(2), 898-903. doi:10.1016/j.ijcard.2012.10.053
- Dennis, P. A., Weinberg, J. B., Calhoun, P. S., Watkins, L. L., Sherwood, A., Dennis, M. F., ... Beckham, J. C. (2016). An investigation of vago-regulatory and health-behavior accounts for increased inflammation in posttraumatic stress disorder. *Journal of Psychosomatic Research*, 83, 33-39.
doi:10.1016/j.jpsychores.2016.02.008
- Deville, G. J., & Huther, A. (2007). Perceived Distress & Endorsement For Cognitive or Exposure Based Treatments Following Trauma. *Australian Psychologist*, 43(1), 7-14. doi:10.1080/00050060601089454
- Donahoe, J. W., & Palmer, D. C. (1994). *Learning and complex behavior* (pp. 18-27). New York, NY: Allyn and Bacon.
- Eagle, G. T., & Kaminer, D. (2015). Traumatic stress: established knowledge, current debates, and new horizons. *South African Journal of Psychology*, 45(1), 22-35.
doi: 10.1177/0081246314547124

Ehlers, A., & Clark, D. M. (2000). A cognitive model of posttraumatic stress disorder. *Behaviour Research and Therapy*, 38(4), 319-345. doi:10.1016/S0005-7967(99)00123-0

Ehlers, A., Clark, D. M., Dunmore, E., Jaycox, L., Meadows, E., & Foa, E. B. (1998). Predicting response to exposure treatment in PTSD: the role of mental defeat and alienation. *Journal of Traumatic Stress*, 11(3), 457-71. doi:10.123/A:1024448511504

Elliott, R. (1989). Comprehensive process analysis: Understanding the change process in significant therapy events. In M. Packer & R. B. Addison (Eds.), *Entering the circle: Hermeneutic investigation in psychology* (pp. 165-184). Albany, NY: SUNY Press.

Elliott, R. (2002). Hermeneutic Single Case Efficacy Design. *Psychotherapy Research*, 12(1), 1-20. doi:10.1080/713869614

Elliott, R. (2012). Qualitative Methods for Studying Psychotherapy Change Processes. In D. Harper & A. R. Thompson (Eds.), *Qualitative Research Methods in Mental Health & Psychotherapy: An Introduction for Students & Practitioners* (pp. 69-81). Chichester: Wiley-Blackwell.

Elofsson, U. O., von Scheele, B., Theorell, T., & Söndergaard, H. P. (2008). Physiological correlates of eye movement desensitisation and reprocessing. *Journal of Anxiety Disorders*, 22(4), 622-634. doi:10.1016/j.janxdis.2007.05.012

- El-Sheikh, M., Harger, J., & Whitson, S. M. (2001). Exposure to interparental conflict and children's adjustment and physical health: The moderating role of vagal tone. *Child Development*, 72(6), 1617-1636. doi:10.1111/1467-8624.00369
- Engelhard, I. M., Sijbrandij, M., van den Hout, M. A., Rutherford, N. M., Rahim, H. F., & Koçak, F. (2012). Choking under pressure: Degrading flashforwards related to performance anxiety. *Journal of Experimental Psychopathology*, 3(2), 158-167. doi:10.5127/jep.024111
- Engelhard, I. M., van den Hout, M. A., & Smeets, M. A. M. (2011). Taxing working memory reduced emotionality and vividness of images about the Queen's Day tragedy. *Journal of Behaviour Therapy and Experimental Psychiatry*, 42(1), 32-37. doi:10.1016/j.jbtep.2010.09.004
- Engelhard, I. M., van Uijen, S. L., & van den Hout, M. A. (2010a). The impact of taxing working memory on negative and positive memories. *European Journal of Psychotraumatology*, 1(1), 5623-5671. doi:10.3402/ejpt.v1i0.5623
- Engelhard, I. M., van den Hout, M. A., Janssen, W., & van der Beek, J. (2010b). Eye movements reduce vividness and emotionality of "flashforwards". *Behaviour Research and Therapy*, 48(5), 442-447. doi:10.1016/j.brat.2010.01.003
- Erickson, L. D., Hedges, D. W., Vaughn, R. A., & Bair, B. (2013). Prevalence of and Factors Associated With Subclinical Posttraumatic Stress Symptoms and PTSD in Urban and Rural Areas of Montana: A Cross-Sectional Study. *The Journal of Rural Health*, 29(4), 403-412. doi:10.1111/jrh.12017

- EuroQol Group. (1990). EuroQol- a new facility for the measurement of health-related quality of life. *Health Policy*, 16(3), 199-208. doi:10109801
- Eysenck, J., & Rachman, S. J. (1965) *The Causes and Cures of Neurosis*. London: Routledge & Kegan Paul.
- Feilzer, M. (2009). Doing Mixed Methods Research Pragmatically: Implications for the Rediscovery of Pragmatism as a Research Paradigm. *Journal of Mixed Methods Research*, 4(1), 6-16. doi:10.1177/1558689809349691
- Fetzner, M. G., McMillan, K. A., & Asmundson, G. J. G. (2012). Similarities in specific physical health disorder prevalence among formerly deployed Canadian forces veterans with full and subsyndromal ptsd. *Depression & Anxiety*, 29(11), 958-965. doi:10.1002/da.21976
- Fisher, W. W., Kelley, M. E., & Lomas, J. E. (2003). Visual aids and structured criteria for improving visual inspection and interpretation of single-case designs. *Journal of Applied Behavior Analysis*, 36(3), 387-406. doi:10.1901/jaba.2003.36-387
- Floen, S. K., & Elklit, A. (2007). Psychiatric diagnoses, trauma, and suicidality. *Annals of General Psychiatry*, 6(12), 1-8. doi:10.1186/1744-859X-6-12
- Foa, E. B. (1979). Failure in treatment of obsessive-compulsives. *Behaviour Research and Therapy*, 17(3), 169-176. doi:10.1016/0005-7967(79)90031-7
- Foa, E. B., & Chambless, D. L. (1978). Habituation of subjective anxiety during flooding in imagery. *Behaviour Research and Therapy*, 16(6), 391-399. doi:10.1016/0005-7967(78)90010-4

- Foa, E. B., & Kozak, M. J. (1986). Emotional processing of fear: Exposure to corrective information. *Psychological Bulletin*, 99(1), 20-35. doi:10.1037/0033-2909.99.1.20
- Foa, E. B., & McNally, R. J. (1996). Mechanisms of change in exposure therapy. In M. Rapee (Eds.), *Current Controversies in the Anxiety Disorders* (pp. 329-343). New York, NY: The Guilford Press.
- Foa, E. B., & Rothbaum, B. O. (1998). *Treating the Trauma of Rape: Cognitive-Behavioural Therapy for PTSD*. London: The Guildford Press.
- Foa, E. B., Ehlers, A., Clark, D. M., Tolin, D. F., & Orsillo, S. M. (1999). The Posttraumatic Cognitions Inventory (PTCI): development and validation. *Psychological Assessment*, 11(3), 303-314. doi:1040-3590/99/S3.00
- Foa, E. B., Huppert, J. D., & Cahill, S. P. (2006). Emotional processing theory: An update. In B. O. Rothbaum (Ed.), *Pathological anxiety: Emotional processing in etiology and treatment* (pp. 3-24). New York, NY: Guilford.
- Foa, E. B., Rothbaum, B. O., Riggs, D. S., & Murdock, T. B. (1991). Treatment of posttraumatic stress disorder in rape victims: A comparison between cognitive-behavioral procedures and counseling. *Journal of Consulting and Clinical Psychology*, 59(5), 715-723. doi:10.1037/0022-006X.59.5.715
- Fohr, T., Tolvanen, A., Myllymaki, T., Jarvela-Reijonen, E., Rantala, S., Peuhkuri, K., ...Kujala, U. M. (2015). Subjective stress, objective heart rate variability based stress, and recovery on workdays among overweight and psychologically distressed individuals: a cross-sectional study. *Journal of Occupational Medicine and Toxicology*, 10(39), 1-9. doi:10.1186/s12995-015-0081-6

- Francis, L. J. (1996). The development of an abbreviated form of the Revised Junior Eysenck Personality Questionnaire (JEPQR-A) among 13-15 year olds. *Journal of Personality & Individual Differences*, 21(6), 835-844. doi:10.1016/S0191-8869(96)00159-6
- Fried, I., Mukamel, R., & Kreiman, G. (2011). Internally generated preactivation of single neurons in human medial frontal cortex predicts volition. *Neuron*, 69(3), 548-562. doi:10.1016/j.neuron.2010.11.045
- Friedman, M. J., Resick, P. A., Bryant, R. A., Strain, J., Horowitz, M., & Spiegel, D. (2011). Classification of trauma and stressor-related disorders in DSM-5. *Depression & Anxiety*, 28(9), 737-749. doi:10.1002/da.20845
- Frustaci, A., Lanza, G. A., Fernandez, I., di Giannantonio, M., & Pozzi, G. (2010). Changes in psychological symptoms and heart rate variability during EMDR treatment: A case series of subthreshold PTSD. *Journal of EMDR Practice & Research*, 4(1), 3-11. doi:10.1891/1933-3196.4.1.3
- Gallistel, C. R., & Gibbon, J. (2000). Time, rate, and conditioning. *Psychological Review*, 107(2), 289-344. doi:10.1037/0033-295X.107.2.289
- Geisler, F. C. M., Kubiak, T., Siewert, K., & Weber, H. (2013). Cardiac vagal tone is associated with social engagement and self-regulation. *Biological Psychology*, 93(2), 279-286. doi:10.1016/j.biopsycho.2013.02.013
- Gillie, B. L., & Thayer, J. F. (2014). Individual differences in resting heartrate variability and cognitive control in posttraumatic stress disorder. *Frontiers in Psychology*, 758(5), 1-7. doi:10.3389/fpsyg.2014.00758

- Giorgi, G., Perez, F. S. F., D'Antonio, A. C., Mucci, N., Ferrero, C., Cupelli, V., ...Arcangeli, G. (2015). Psychometric properties of the Impact of Event Scale-6 in a sample of victims of bank robbery. *Psychology Research and Behaviour Management*, 8, 99-104. doi:10.2147/prbm.s73901
- Gluck, M. A., Meeter, M., & Myers, C. E. (2003). Computational models of the hippocampal region: Linking incremental learning and episodic memory. *Trends in Cognitive Sciences*, 7, 269-276. doi:10.1037/0033-295X.112.3.560
- Goff, L. M., & Roedinger, H. L. (1998). Imagination inflation for action events: Repeated imaginings lead to illusory recollections. *Memory & Cognition*, 26(1), 20-33. doi:10.3758/BF03211367
- González-Prendes, A. A., & Resko, S. M. (2012). Cognitive-Behavioral Theory. In S. Ringel & J. R. Brandell (Eds.), *Trauma: Contemporary Directions in Theory, Practice and Research* (pp. 14-40). Los Angeles, CA: Sage Publications.
- Grayson, J. B., Foa, E. B., & Steketee, G. (1982). Habituation during exposure treatment: Distraction vs. Attention-focusing. *Behaviour Research and Therapy*, 20(4), 323-328. doi:10.1016/0005-7967(82)90091-2
- Grey, N., Young, K., & Holmes, E. (2002). Cognitive Restructuring Within Reliving: a Treatment for Peritraumatic Emotional “Hotspots” in Posttraumatic Stress Disorder. *Behavioural and Cognitive Psychotherapy*, 30(01), 37-56. doi:10.1017/S1352465802001054
- Guay, S., Billette, V., & Marchand, A. (2006). Exploring the links between posttraumatic stress disorder and social support: Processes and potential research avenues. *Journal of Traumatic Stress*, 19(3), 327-338. doi: 10.1002/jts.20124

- Guédon-Moreau, L., Ducrocq, F., Molenda, S., Duhem, S., Salleron, J., Chaudieu, I., ...Vaiva, G. (2012). Temporal analysis of heart rate variability as a predictor of post-traumatic stress disorder in road traffic accidents survivors. *Journal of Psychiatric Research*, 46(6), 790-796. doi:10.1016/j.jpsychires.2012.02.006
- Gunter, R. W., & Bodner, G. E. (2008). How eye movements affect unpleasant memories: Support for a working-memory account. *Behaviour Research and Therapy*, 46(8), 913-931. doi:10.1016/j.brat.2008.04.006
- Gunter, R. W., & Bodner, G. E. (2009). EMDR Works . . . But How? Recent Progress in the Search for Treatment Mechanisms. *Journal of EMDR Practice and Research*, 3(3), 161-168. doi:10.1891/1933-3196.3.3.161
- Hageman, W. J. J. M., & Arrindell, W. A. (1993). A further refinement of the reliable change (RC) index by Improving the pre-post Difference score: introducing RCID. *Behaviour Research and Therapy*, 31(7), 693-700. doi:10.1016/0005-7967(93)90122-B
- Hall, R. (2013). Mixed Methods: In Search of a Paradigm. In T. Le & Q. Le (Eds.), *Conducting Research in a Changing and Challenging World* (pp.71-78). New York, NY: Nova Science Publishers.
- Haller, M., Case, J., Crone, N. E., Chang, E. F., King-Stephens, D., Laxer, K. D., ...Shestyuk, A. Y. (2017). Persistent neuronal activity in human prefrontal cortex links perception and action. *Nature Human Behaviour*, 2, 80-91. doi:10.1038/s41562-017-0267-2

- Halligan, S. L., Michael, T., Clark, D. M., & Ehlers, A. (2003). Posttraumatic stress disorder following assault: the role of cognitive processing, trauma memory, and appraisals. *Journal of Consulting and Clinical Psychology, 71*(3), 419-431. doi:10.1037/0022-006X.71.3.419
- Hansen, K., Höfling, V., Kröner-Borowik, T., Stangier, U., & Steil, R. (2013). Efficacy of psychological interventions aiming to reduce chronic nightmares: a meta-analysis. *Clinical Psychology Review, 33*(1), 146-155. doi:10.1016/j.cpr.2012.10.012.
- Hayano, J., Sakakibara, Y., Yamada, M., Ohte, N., Fujinami, T., Yokoyama, K., ... Takata, K. (1990). Decreased magnitude of heart rate spectral components in coronary artery disease. its relation to angiographic severity. *Circulation, 81*(4), 1217-1224. doi:10.1161/01.CIR.81.4.1217
- Hayes, S. C., Levin, M., Plumb-Villardaga, J., Villatte, J., & Pistorello, J. (2013). Acceptance and Commitment Therapy and contextual behavioral science: Examining the progress of a distinctive model of behavioral and cognitive therapy. *Behavior Therapy, 44*(2), 180-198. doi:10.1016/j.beth.2009.08.002
- Hayes, S. C., Wilson, K. G., Gifford, E. V., Follette, V. M., & Strosahl, K. (1996). Experiential avoidance and behavioural disorders: A functional dimensional approach to diagnosis and treatment. *Journal of Consulting and Clinical Psychology, 64*(6), 1152-1168. doi:10.1037/0022-006X.64.6.1152
- Haynes, J. (2011). Decoding and predicting intentions. *Annals of the New York Academy of Sciences, 1224*(1), 9-21. doi:10.1111/j.1749-6632.2011.05994.x

- Haynes, J. D., Sakai, K., Rees, G., Gilbert, S., Frith, C., & Passingham, R. E. (2007).
Reading hidden intentions in the human brain. *Current Biology*, 17(4), 323-328.
doi:10.1016/j.cub.2006.11.072
- Herman, J. (1992). *Trauma and Recovery*. New York, NY: Basic Books.
- Hirata, M., Koreeda, S., Sakihara, K., Kato, A., Yoshimine, T., & Yorifuji, S. (2007).
Effects of the emotional connotations in words on the frontal areas-a spatially
filtered MEG study. *Neuroimage* 35(1), 420-429.
doi:10.1016/j.neuroimage.2006.11.025
- Hoge, C. W., Castro, C. A., Messer, S. C., McGurk, D., Cotting, D. I., & Koffman, R.
L. (2004). Combat duty in Iraq and Afghanistan, mental health problems, and
barriers to care. *New England Journal of Medicine*, 351(1), 13-22.
doi:10.1056/NEJMoa040603
- Hornsveld, H., Houtveen, J. H., Vroomen, M., Aalbers, I. K. D., Aalbers, D., & van den
Hout, M. A. (2011). Evaluating the Effect of Eye Movements on Positive
Memories Such as Those Used in Resource Development and Installation.
Journal of EMDR Practice and Research, 5(4), 146-155. doi:10.1891/1933-
3196.5.4.146
- Imel, Z. E., Laska, K., Jakupcak, M., & Simpson, T. L. (2013). Meta-
analysis of dropout in treatments for posttraumatic stress disorder. *Journal of C
onsulting and Clinical Psychology*, 81(3), 394-404. doi:10.1037/a0031474

Jackson, D. C., Malmstadt, J. R., Larson, C. L., & Davidson, R. J. (2000). Suppression and enhancement of emotional responses to unpleasant pictures.

Psychophysiology, 37(4), 515-522. doi:10.1017/S0048577200990401

Jacobson, N. S., & Truax, P. (1991). Clinical significance: A statistical approach to defining meaningful change in psychotherapy research. *Journal of Consulting and Clinical Psychology*, 59(1), 12-19. doi:10.1037/0022-006x.59.1.12

Jakovljević, M., Brajković, L., Jakšić, N., Lončar, M., Aukst-Margetić, B., & Lasić, D. (2012). Posttraumatic Stress Disorders (Ptd) From Different Perspectives: A Transdisciplinary Integrative Approach. *Psychiatria Danubina*, 24(3), 246-255.

Jakupcak, M., Conybeare, D., Phelps, L., Hunt, S., Holmes, H. A., Felker, B., ...

McFall, M. E. (2007). Anger, hostility, and aggression among Iraq and Afghanistan war veterans reporting PTSD and subthreshold PTSD. *Journal of Traumatic Stress*, 20(6), 945-954. doi:10.1002/jts.20258

Jaycox, L. H., Foa, E. B., & Morral, A. R. (1998). Influence of emotional engagement and habituation on exposure therapy for PTSD. *Journal of Consulting Clinical Psychology*, 66(1), 185-192. doi:10.1037/0022-006X.66.1.185

Jeon, H. J., Suh, T., Lee, H. J., Hahm, B. J., Lee, J. Y., Cho, S. J., ...Cho, M. J. (2007). Partial versus full PTSD in the Korean community: prevalence, duration, correlates, comorbidity, and dysfunctions. *Depression and Anxiety*, 24(8), 577-585. doi:10.1002/da.20270

- Jiang, Y. (2001). Abductive Reasoning as Pragmatic Inference - Towards a Formal Theory of Pragmatics. In H. Pan (Eds.), *Studies in Chinese Linguistics, Volume II, Linguistic Society of Hong Kong Series* (pp. 91-115). Hong Kong: Linguistic Society of Hong Kong.
- Johnstone, K. A., & Page, A. C. (2004). Attention to phobic stimuli during exposure: The effect of distraction on anxiety reduction, self-efficacy and perceived control. *Behaviour Research and Therapy*, 42(3), 249-275.
doi:10.1016/S00057967(03)00137-2
- Jones, E., & Wessely, S. (2007). A paradigm shift in the conceptualization of psychological trauma in the 20th century. *Journal of Anxiety Disorders* 21(2), 164-75. doi:10.1016/j.janxdis.2006.09.009
- Jordan, N. N., Hoge, C. W., Tobler, S. K., Wells, J., Dydek, G. J., & Egerton, W. E. (2004). Mental health impact of 9/11 pentagon attack: Validation of a rapid assessment tool. *American Journal of Preventative Medicine*, 26(4), 284-93.
doi:10.1016/j.amepre.2004.01.005
- Kalat, J. W. (2001). *Biological psychology* (8th ed.), Australia: Wadsworth.
- Kane, M. J., & Engle, R. W. (2002). The role of prefrontal cortex in working-memory capacity, executive attention, and general fluid intelligence: An individual-differences perspective. *Psychonomic Bulletin and Review*, 9(4), 637-671.
doi:10.3758/BF03196323
- Kavanagh, D. J., Freese, S., Andrade, J., & May, J. (2001). Effects of visuospatial tasks on desensitisation to emotive memories. *British Journal of Clinical Psychology*, 40(3), 267-80. doi:10.1348/014466501163689

- Kazdin, A. E. (2001). Progression of Therapy Research and Clinical Application of Treatment Require Better Understanding of the Change Process. *Clinical Psychology Science and Practice*, 8(2), 143-151. doi:10.1093/clipsy.8.2.143
- Kazdin, A. E. (2008). Understanding how and why psychotherapy leads to change. *Psychotherapy Research*, 19(4-5), 418-428. doi:10.1080/10503300802448899
- Kazdin, A. E. (2011). *Single-case research designs: Methods for clinical and applied settings* (2nd ed.). New York, NY: Oxford University Press.
- Kemp, A. H., Quintana, D. S., Felmingham, K. L., Matthews, S., & Jelinek, H. F. (2012). Depression, comorbid anxiety disorders, and heart rate variability in physically healthy, unmedicated patients: Implications for cardiovascular risk. *PLoS ONE*, 7(2), 1-8. doi:10.1371/journal.pone.0030777
- Kemps, E., & Tiggemann, M. (2007). Reducing the vividness and emotional impact of distressing autobiographical memories: The importance of modality-specific interference. *Memory*, 15(4), 412-422. doi:10.1080/09658210701262017
- Kessler, R. C., & Ustun, T. B. (2008). *The WHO World Mental Health Surveys: global perspectives on the epidemiology of mental disorders* (Eds.). New York, NY: Cambridge University Press.
- Kessler, R. C., Sonnega, A., Bromet, E., Hughes, M., & Nelson, C. B. (1995). Posttraumatic Stress Disorder in the National Comorbidity Survey. *National Comorbidity Survey*, 5(1), 48-60. doi:10.1001/archpsyc.1995.03950240066012

- Kessler, R., Chiu, W., Demler, O., Merikangas, K., & Walters, E. (2005). Prevalence, severity, and comorbidity of 12-month DSM-IV disorders in the national comorbidity survey replication. *Archives of General Psychiatry*, 62(7), 709-709. doi:10.1001/archpsyc.62.6.617
- Kircher, T., Arolt, V., Jansen, A., Pyka, M., Reinhardt, I., Kellermann, T., ... Straube, B. (2013). Effect of cognitive-behavioral therapy on neural correlates of fear conditioning in panic disorder. *Biological Psychiatry*, 73(1), 93-101. doi:10.1016/j.biopsych.2012.07.026
- Koenen, K. C., Stellman, S. D., Sommer, J. F., & Stellman, J. M. (2008). Persisting posttraumatic stress disorder symptoms and their relationship to functioning in Vietnam veterans: A 14-year follow-up. *Journal of Traumatic Stress*, 21(1), 49-57. doi:10.1002/jts.20304
- Kolassa, I., Ertle, V., Eckart, C., Kolassa, S., Onyut, L. P., & Elbert, T. (2010). Spontaneous Remission from PTSD Depends on the Number of Traumatic Event Types Experienced. *American Psychological Association*, 2(3), 169-174. doi:10.1037/a0019362
- Kosslyn, S. M. (1994). *Image and Brain: The Resolution of the Imagery Debate*. Cambridge, MA: MIT Press.
- Kratochwill, T. R., Hitchcock, J. H., Horner, R. H., Levin, J. R., Odom, S. L., Rindskopf, D. M., ... Shadish, W. R. (2010). Single-Case Intervention Research Design Standards. *Remedial and Special Education*, 34(1), 26-38. doi:10.1177/0741932512452794

- Kutz, I., Resnik, V., & Dekel, R. (2008). The Effect of Single-Session Modified EMDR on Acute Stress Syndromes. *Journal of EMDR Practice and Research*, 2(3), 190-200. doi:10.1891/1933-3196.2.3.190
- Laborde, A., Mosley, E., & Thayer, J. F. (2017). Heart Rate Variability and Cardiac Vagal Tone in Psychophysiological Research - Recommendations for Experiment Planning, Data Analysis, and Data Reporting. *Frontiers in Psychology*, 213(8), 1-18. doi:10.3389/fpsyg.2017.00213
- Lane, J. D., & Gast, D. L. (2014). Visual analysis in single case experimental design studies: brief review and guidelines. *Neuropsychological Rehabilitation*, 24(3-4), 445-463. doi:10.1080/09602011.2013.815636
- Lee, C. W., & Cuijpers, P. (2013). A meta-analysis of the contribution of eye movements in processing emotional memories. *Journal of Behaviour Therapy and Experimental Psychiatry*, 44(2), 231-239. doi:10.1016/j.jbtep.2012.11.001.
- Lee, C. W., Taylor, G., & Drummond, P. D. (2006). The Active Ingredient in EMDR: Is It Traditional Exposure or Dual Focus of Attention ? *Clinical Psychology and Psychotherapy*, 13(2), 97-107. doi:10.1002/cpp.479
- Lee, Y., Wu, Y., Chien, C., Fang, F., & Hung, C. (2016). Use of the Hospital Anxiety and Depression Scale and the Taiwanese Depression Questionnaire for screening depression in head and neck cancer patients in Taiwan. *Neuropsychiatric Disease and Treatment*, 12, 2649-2657. doi:10.2147/NDT.S112069
- Lenz, A. S. (2013). Calculating effect size in single-case research: A comparison of nonoverlap methods. *Measurement and Evaluation in Counseling and Development*, 46(1), 64-73. doi:10.1177/0748175612456401

- Libet, B. (1985). Unconscious Cerebral Initiative and the Role of Conscious will in voluntary action. *Behavioral and Brain Sciences*, 8(4), 529-566.
doi:10.1017/s0140525x00044903
- Licanin, I., & Redzic, A. (2002). Posttraumatic stress disorder (ptsd) and comorbidity. *Bosnian Journal of Basic Medical Sciences*, 2(1-2), 57-61.
- Logie, R. (2014). ARTICLE EMDR - more than just a therapy for PTSD ? *The Psychologist*, 27(7), 512-517. Retrieved from
<https://thepsychologist.bps.org.uk/volume-27/edition-7/emdr-more-just-therapy-ptsd>
- Lohr, J. M., Lilienfeld, S. O., Tolin, D. F., & Herbert, J. D. (1999). Eye movement desensitization and reprocessing: An analysis of specific versus nonspecific treatment factors. *Journal of Anxiety Disorders*, 13(1-2), 185-207.
doi:10.1016/S0887-6185(98)00047-4
- Long, M. E., Elhai, J. D., Schweinle, A., Gray, M. J., Grubaugh, A. L., & Frueh, B. C. (2008). Differences in posttraumatic stress disorder diagnostic rates and symptom severity between Criterion A1 and non-Criterion A1 stressors. *Journal of Anxiety Disorders*, 22(7), 1255-1263. doi:10.1016/j.janxdis.2008.01.006
- Lovibond, P. F., & Lovibond, S. H. (1995). The structure of negative emotional states: comparison of the Depression Anxiety Stress Scales (DASS) with the Beck Depression and Anxiety Inventories. *Behaviour Research and Therapy*, 33(3), 335-343. doi:10.1016/0005-7967(94)00075-U

- Lyonfields, J. D., Borkovec, T. D., & Thayer, J. F. (1995). Vagal tone in generalized anxiety disorder and the effects of aversive imagery and worrisome thinking. *Behavior Therapy*, 26(3), 457-466. doi:10.1016/S0005-7894(05)80094-2
- Lyons, J. A., & Keane, T. M. (1989). Implosive therapy for the treatment of combat-related PTSD. *Journal of Traumatic Stress*, 2(2), 137-152.
doi:10.1007/BF00974155
- Ma, H. H. (2006). An alternative method for quantitative synthesis of single-subject researches: Percentage of data points exceeding the median. *Behavior Modification*, 30(5), 598-617. doi:10.1177/0145445504272974
- March, J. S. (1993). What constitutes a stressor? In J. R. T. Davidson & E. B. Foa (Eds.) *Posttraumatic stress disorder* (pp.37-54). Washington, DC: American Psychiatric Press
- Martin, J. (1990). Deconstructing organizational taboos: The suppression of gender conflict in organizations. *Organization Science*, 1(4), 339-359.
doi:10.1287/orsc.1.4.339
- Massad, P. M., & Hulsey, T. L. (2006). Causal attributions in posttraumatic stress disorder: Implications for clinical research and practice. *Psychotherapy: Theory, Research, Practice, Training*, 43(2), 201-215. doi:10.1037/0033-3204.43.2.201
- Maxfield, L. J. (2004). *A working memory analysis of the dual attention component of eye movement desensitisation and reprocessing*. (Unpublished doctoral dissertation). Lakehead University, Canada.

- Maxfield, L., & Melnyk, W. T. (2000). Single session treatment of test anxiety with eye movement desensitization and reprocessing (EMDR). *International Journal of Stress Management*, 7(2), 87-101. doi:10.1023/A:1009580101287
- Mayou, R., Bryant, B., & Ehlers, A. (2001). Prediction of psychological outcomes one year after a motor vehicle accident. *American Journal of Psychiatry*, 158(8), 1231-1238. doi:10.1176/appi.ajp.158.8.1231
- McCleery, J. M., & Harvey, A. G. (2004). Integration of psychological and biological approaches to trauma memory: implications for pharmacological prevention of PTSD. *Journal of Traumatic Stress*, 17(6), 485-496. doi:10.1007/s10960-004-5797-5
- McCrae, R. R., Kurtz, J. E., Yamagata, S., & Terracciano, A. (2011). Internal Consistency, Retest Reliability, and their Implications For Personality Scale Validity. *Personality and Social Psychology Review*, 15(1), 28-50. doi:10.1177/1088868310366253
- McCraty, R., Atkinson, M., Tiller, W. A., Rein, G., Watkins, A. D. (1995). The effects of emotions on short-term power spectrum analysis of heart rate variability. *The American Journal of Cardiology*, 76(14), 1089-1093. doi:10.1016/S0002-9149(99)80309-9
- McCrone, P. R., Dhanasiri, S., Patel, A., Knapp, M., & Lawton-Smith, S. (2008). *Paying the price: The cost of mental health care in England to 2026*. London: Kings Fund.

- McFarlane, A. C., Bookless, C., & Air, T. (2001). Posttraumatic stress disorder in a general psychiatric inpatient Population. *Journal of Traumatic Stress, 14*(4), 633-645. doi:10.1023/A:1013077702520
- McLaughlin, K. A., Koenen, K. C., Friedman, M. J., Ruscio, A. M., Karam, E. G., Shahly, V., ...Kessler, R. C. (2015). Archival report: Subthreshold posttraumatic stress disorder in the world health organization world mental health surveys. *Biological Psychiatry, 77*, 375-384. doi:10.1016/j.biopsych.2014.03.028
- McManus, S., Meltzer, H., Brugha, T., Bebbington, P., & Jenkins, R. (2009). *Adult psychiatric morbidity in England, 2007: Results of a household survey*. Retrieved from <https://digital.nhs.uk/data-and-information/publications/statistical/adult-psychiatric-morbidity-survey/adult-psychiatric-morbidity-in-england-2007-results-of-a-household-survey>
- McNally, R. J. (2003). Progress and Controversy in the Study of Posttraumatic Stress Disorder. *Annual Review of Psychology, 54*(1), 229-252. doi:10.1146/annurev.psych.54.101601.145112
- McNally, R. J. (2007). Mechanisms of exposure therapy: How neuroscience can improve psychological treatments for anxiety disorders. *Clinical Psychology Review, 27*(6), 750-759. doi:10.1016/j.cpr.2007.01.003
- McNally, R. J. (2010). Can we salvage the concept of psychological trauma? *Psychologist, 23*(5), 386-389.
- McNally, R. J. (2011). *What is mental illness?* Cambridge, MA: Belknap Press of Harvard University Press.

- McCue, P., Buchanan, T., & Martin, C. R. (2006). Screening for psychological distress using internet administration of the Hospital Anxiety and Depression Scale (HADS) in individuals with chronic fatigue syndrome. *British Journal of Clinical Psychology, 45*, 483-498. doi:10.1348/014466505X82379
- Meuret, A. E., Seidel, A., Rosenfield, B., Hofmann, S. G., & Rosenfield, D. (2012). Does fear reactivity during exposure predict panic symptom reduction? *Journal of Consulting and Clinical Psychology, 80*(5), 773-785. doi:10.1037/a0028032
- Minassian, A., Maihofer, A. X., Baker, D. G., Nievergelt, C. M., Geyer, M. A., & Risbrough, V. B. (2015). Marine Resiliency Study Team. Association of predeployment heart rate variability with risk of postdeployment posttraumatic stress disorder in active-duty Marines. *JAMA Psychiatry, 72*(10), 979-986. doi:10.1001/jamapsychiatry.2015.0922
- Mitchell, K. S., Mazzeo, S. E., Schlesinger, M. R., Brewerton, T. D., & Smith, B. N. (2012). Comorbidity of partial and subthreshold ptsd among men and women with eating disorders in the national comorbidity survey-replication study. *International Journal of Eating Disorders, 45*(3), 307-315. doi:10.1002/eat.20965
- Mol, S. S. L., Arntz, A., Metsemakers, J. F. M., Dinant, G. J., Vilters-Van Montfort, P. A. P., & Knottnerus, J. A. (2005). Symptoms of post-traumatic stress disorder after non-traumatic events: Evidence from an open population study. *British Journal of Psychiatry, 186*(6), 494-499. doi:10.1192/bjp.186.6.494

- Morgan, D. L. (2007). Paradigms Lost and Pragmatism Regained: Methodological Implications of Combining Qualitative and Quantitative Methods. *Journal of Mixed Methods Research*, 1(1), 48-76. doi:10.1177/2345678906292462
- Morgan, D. L., & Morgan, R. K. (2009). *Single-case research methods for the behavioral and health sciences*. Thousand Oaks, CA: Sage.
- Morley, S. (2018). *Single-Case Methods in Clinical Psychology: A Practical Guide*. London: Routledge.
- Mowrer, O. H. (1956). Two-factor learning theory reconsidered, with special reference to secondary reinforcement and the concept of habit. *Psychological Review*, 63, 114-128. doi:10.1037/h0040613
- Mowrer, O. H. (1960). *Learning theory and the symbolic processes*. New York, NY: Wiley.
- Mueser, K. T., Goodman, L. B., Trumbetta, S. L., Rosenberg, S. D., Osher, F. C., Vidaver, R., ... Foy, D. W. (1998). Trauma and posttraumatic stress disorder in severe mental illness. *Journal of Consulting and Clinical Psychology*, 66(3), 493-499.
- Müller, M., Vandeleur, C., Rodgers, S., Rössler, W., Castelao, E., Preisig, M., & Ajdacic-Gross, V. (2014). Factors associated with comorbidity patterns in full and partial PTSD: Findings from the PsyCoLaus study. *Comprehensive Psychiatry*, 55(4), 837-848. doi:10.1016/j.comppsy.2014.01.009

- Murburg, M. M. (1997). The psychobiology of posttraumatic stress disorder: An overview. *Annals of the New York Academy of Sciences*, 821(1), 352-358. doi:10.1111/j.1749-6632.1997.tb48291.x
- Muris, P., Merckelbach, H., van Haaften, H., & Mayer, B. (1997). Eye movement desensitisation and reprocessing versus exposure in vivo. A single-session crossover study of spider phobic children. *British Journal of Psychiatry*, 171, 82-86. doi:10.1192/bjp.171.1.82
- Mylle, J., & Maes, M. (2004). Partial posttraumatic stress disorder revisited. *Journal of Affective Disorders*, 78(1), 37-48. doi:10.1016/S0165-0327(02)00218-5
- Mystkowski, J. L., Craske, M. G., & Echiverri, A. M. (2002). Treatment context and return of fear in spider phobia. *Behavior Therapy*, 33(3), 399-416. doi:10.1016/S0005-7894(02)80035-1
- Naghavi, S. H. R., Shabestari, O., & Alcolado, J. (2013). Post-traumatic stress disorder in trainee doctors with previous needlestick injuries. *Occupational Medicine*, 63(4), 260-265. doi:10.1093/occmed/kqt027
- Naylor, C. J., Dolber, T. R., Strauss, J. L., Kilts, J. D., Strauman, T. J., Bradford, D. W., ... Marx, C. E. (2013). A pilot randomised controlled trial with paroxetine for subthreshold PTSD in Operation Enduring Freedom/ Operation Iraqi Freedom era veterans. *Psychiatry Research*, 206, 318-320. doi:10.1016/j.psychres.2012.11.008
- NICE. (2005). *Post-traumatic stress disorder: management*. Retrieved from <https://www.nice.org.uk/guidance/CG26>

- Nishith, P., Duntley, S. P., Domitrovich, P. P., Uhles, M. L., Cook, B. J., & Stein, P. K. (2003). Effect of cognitive behavioral therapy on heart rate variability during REM sleep in female rape victims with PTSD. *Journal of Traumatic Stress*, 16(3), 247-250. doi:10.1023/a:1023791906879
- Nunan, D., Jakovljević, D. G., Donovan, G., Singleton, L. D., Sandercock, G. R., & Brodie, D. A. (2010). Resting autonomic modulations and the heart rate response to exercise. *Clinical Autonomic Research*, 20(4), 213-221. doi:10.1007/s10286-010-0073-7
- Nunnally, J. C., & Bernstein, I. H. (1994). *Psychometric Theory*. New York, NY: McGraw-Hill.
- O'Donovan, A., Neylan, T. C., Metzler, T., & Cohen, B. E. (2012). Lifetime exposure to traumatic psychological stress is associated with elevated inflammation in the Heart and Soul Study. *Brain, Behavior, and Immunity*, 26(4), 642-649. doi:10.1016/j.bbi.2012.02.003
- Oliver, N. S., & Page, A. C. (2003). Fear reduction during in vivo exposure to blood injection stimuli: Distraction vs. attentional focus. *British Journal of Clinical Psychology*, 42(1), 13-25. doi:10.1348/014466503762841986
- Oren, E., & Solomon, R. (2012). EMDR therapy : An overview of its development and mechanisms of action. *European Review of Applied Psychology / Revue Européenne de Psychologie Appliquée*, 62(4), 197-203. doi:10.1016/j.erap.2012.08.005

- Ozer, E. J., Best, S. R., Lipsey, T. L., & Weiss, D. S. (2003). Predictors of posttraumatic stress disorder and symptoms in adults: A meta-analysis. *Psychological Bulletin*, 129(1), 52-73. doi:10.1037/0033-2909.129.1.52
- Packard, M. G., & Knowlton, B. J. (2002). Learning and memory functions of the Basal Ganglia. *Annual Review of Neuroscience*, 25(1), 563-593.
doi:10.1146/annurev.neuro.25.112701.142937
- Pagani, M., Di Lorenzo, G., Monaco, L., Daverio, A., Giannoudas, I., La Porta, P., ... Siracusano, A. (2015). Neurobiological response to EMDR therapy in clients with different psychological traumas. *Frontiers in Psychology*, 6(1614), 1-12.
doi:10.3389/fpsyg.2015.01614
- Pagani, M., Di Lorenzo, G., Verardo, A. R., Nicolais, G., Monaco, L., Lauretti, G., ... Siracusano, A. (2012). Neurobiological Correlates of EMDR Monitoring - An EEG Study. *PLoS ONE*, 7(9), 1-12. doi:10.1371/journal.pone.0045753
- Pagani, M., Högberg, G., Salmaso, D., Tarnell, B., Nardo, D., Sundin, Ö., ...Hällström, T. (2007). Effects of EMDR psychotherapy on 99mTc-HMPAO distribution in occupation-related post-traumatic Stress disorder. *Nuclear Medicine Communications*, 28(10), 757-765. doi:10.1097/MNM.0b013e3282742035
- Parker, R. I., & Hagan-Burke, S. (2007). Median-based overlap analysis for single case data: A second study. *Behavior Modification*, 31(6), 919-936.
doi:10.1177/0145445507303452
- Parvaiz, G. S., Mufti, O., & Wahab, M. (2016). Pragmatism for Mixed Method Research at Higher Education Level. *Business and Economic Review*, 8(2), 67-79. doi:10.22547/BER/8.2.5

- Patton, M. Q. (1990) *Qualitative evaluation and research methods*. Thousands Oaks, CA: Sage Publications, Inc.
- Penfold, K., & Page, A. C. (1999). The effect of distraction on within-session anxiety reduction during brief in vivo exposure for mild blood-injection fears. *Behavior Therapy*, 30(4), 607-621. doi:10.1016/S0005-7894(99)80028-8
- Pietrzak, R. H., Goldstein, R. B., Southwick, S. M., & Grant, B. F. (2011). Prevalence and axis I comorbidity of full and partial posttraumatic stress disorder in the United States: Results from wave 2 of the national epidemiologic survey on alcohol and related conditions. *Journal of Anxiety Disorders*, 25(3), 456-465. doi:10.1016/j.janxdis.2010.11.010
- Pietrzak, R. H., Schechter, C. B., Bromet, E. J., Katz, C. L., Reissman, D. B., Ozbay, F., ... Southwick, S. M. (2012). The burden of full and subsyndromal posttraumatic stress disorder among police involved in the world trade center rescue and recovery effort. *Journal of Psychiatric Research*, 46(7), 835-842. doi:10.1016/j.jpsychires.2012.03.011
- Pitman, R. K., Gilbertson, M. W., Gurvits, T. V., May, F. S., Lasko, N. B., Metzger, L. J., ... Orr, S. P. (2006). Clarifying the origin of biological abnormalities in PTSD through the study of identical twins discordant for combat exposure. *Annals of the New York Academy of Sciences*, 1071, 242-254. doi:10.1196/annals.1364.019
- Porges, S. W. (1995). Orienting in a defensive world: Mammalian modifications of our evolutionary heritage. A polyvagal theory. *Psychophysiology*, 32(4), 301-318. doi: 10.1111/j.1469-8986.1995.tb01213.x

- Porges, S. W. (1997). Emotion: an evolutionary by-product of the neural regulation of the autonomic nervous system. *Annals of the New York Academy of Sciences*, 15(807), 62-77. doi:10.1111/j.1749-6632.1997.tb51913.x
- Porges, S. W. (1998). Love: An emergent property of the mammalian autonomic nervous system. *Psychoneuroendocrinology*, 23, 837-861. doi:10.1016/S0306-4530(98)00057-2
- Porges, S. W. (2003). Social engagement and attachment: A phylogenetic perspective. *Annals of the New York Academy of Sciences*, 1008(1), 31-47. doi:10.1196/annals.1301.004
- Porges, S. W. (2004). Neuroception: A Subconscious System for Detecting Threats and Safety. *Zero to Three*, 24(5), 19-24.
- Porges, S. W. (2007). The polyvagal perspective. *Biological Psychology*, 74(2), 116-143. doi:10.1016/j.biopsycho.2006.06.009
- Porges, S. W. (2011). *The polyvagal theory: Neurophysiological foundations of emotions, attachment, communication, and self-regulation (Norton series on interpersonal neurobiology)*. New York, NY: WW Norton & Company.
- Quinn, J. G., & McConnell, J. (1996). Irrelevant Pictures in Visual Working Memory. *Quarterly Journal of Experimental Psychology*, 49(1), 200-215. doi:10.1080/713755613
- Rassafiani, M., & Sahaf, R. (2010). Single case experimental design: an overview. *International Journal of Therapy and Rehabilitation*, 17(6), 285-289. doi:10.12968/ijtr.2010.17.6.48151

- Ray, D. C. (2014). Single-Case Research Design and Analysis: Counseling Applications. *Journal of Counseling & Development*, 93(4), 394-402.
doi:10.1002/jcad.12037
- Recklitis, C. J., Yap, L., & Noam, G. (1995). Development of a short form of the Adolescent version of the Defense Mechanisms Inventory. *Journal of Personality Assessment*, 64(2), 360-370. doi:10.1207/s15327752jpa6402_14
- Richards, D., & Lovell, K. (1999). Behavioural and cognitive behavioural interventions in the treatment of PTSD. In W. Yule (Eds.), *Post-Traumatic Stress Disorders: Concepts and therapy* (pp. 239-266). Chichester: Wiley.
- Richardson, P., Williams, S. R., Hepenstall, S., Gregory, L., McKie, S., & Corrigan, F. (2009). A single-case fMRI study: EMDR treatment of a patient with posttraumatic stress disorder. *Journal of EMDR Practice and Research*, 3(1), 10-23. doi:10.1891/1933-3196.3.1.10
- Rodgers, S., & Silver, S. M. (2002) Is EMDR an Exposure Therapy? A Review of Trauma Protocols. *Journal of Clinical Psychology*, 58(1), 43-59.
doi:10.1002/jclp.1128
- Rodriguez, B. I., & Craske, M. G. (1993). The effects of distraction during exposure to phobic stimuli. *Behaviour Research and Therapy*, 31(6), 549-558.
doi:10.1016/0005-7967(93)90106-5

- Rogers, S., Silver, S. M., Goss, J., Obenchain, J., Willis, A., & Whitney, R. L. (1999). A Single Session, Group Study of Exposure and Eye Movement Desensitization and Reprocessing in Treating Posttraumatic Stress Disorder Among Vietnam War Veterans: Preliminary Data. *Journal of Anxiety Disorders*, 13(1-2), 119-130. doi:10.1016/s0887-6185(98)00043-7
- Roth, A. D., & Parry, G. (1997). The implications of psychotherapy research for clinical practice and service development: Lessons and limitations. *Journal of Mental Health*, 6(4), 367-380. doi:10.1080/09638239718699
- Roth, A., & Fonagy, P. (2005). *What Works For Whom: A Critical Review of Psychotherapy Research* (2nd Ed.). New York, NY: Guildford Press.
- Rothbaum, B. O., Astin, M. C., & Marsteller, F. (2005). Prolonged exposure versus Eye Movement Desensitization and Reprocessing (EMDR) for PTSD rape victims. *Journal of Traumatic Stress*, 18(6), 607-616. doi:10.1002/jts.20069
- Rottenberg, J., Wilhelm, F. H., Gross, J. J., & Gotlib, I. H. (2003). Vagal rebound during resolution of tearful crying among depressed and nondepressed individuals. *Psychophysiology*, 40(1), 1-6. doi:10.1111/1469-8986.00001
- Rubin, D. C., & Feeling, N. (2013). Measuring the severity of negative and traumatic events. *Clinical Psychological Science*, 1(4), 375-389. doi:10.1177/2167702613483112
- Rubin, D. C., Berntsen, D., & Bohni, M. K. (2008). A memory-based model of posttraumatic stress disorder: Evaluating basic assumptions underlying PTSD diagnosis. *Psychological Review*, 115(4), 985-1011. doi:10.1037/a0013397

- Ruscio, A. M., & Holohan, D. R. (2006). Applying empirically supported treatments to complex cases: Ethical, empirical, and practical considerations. *Clinical Psychology: Science & Practice*, 13(2), 146-162. doi:10.1111/j.1468-2850.2006.00017.x
- Sack, M., Hofmann, A., Wizelman, L., & Lempa, W. (2008). Psychophysiological Changes During EMDR and Treatment Outcome. *Journal of EMDR Practice and Research*, 2(4), 239-246. doi:10.1891/1933-3196.2.4.239
- Sahar, T., Shalev, A. Y., & Porges, S. W. (2001). Original article: Vagal modulation of responses to mental challenge in posttraumatic stress disorder. *Biological Psychiatry*, 49(7), 637-643. doi:10.1016/S00063223(00)01045-3
- Salkovskis, P. M. (1995). Demonstrating specific effects in cognitive and behavioural therapy. In M. Aveline & D. A. Shapiro (Eds.), *Research Foundations for Psychotherapy Research* (pp. 191-228). Chichester: Wiley.
- Sanderson, C. (2006). *Counselling adult survivors of child sexual abuse* (3rd ed.). London, England: Jessica Kingsley Publishers.
- Sayed, S., Iacoviello, B. M., & Charney, D. S. (2015). Risk Factors for the Development of Psychopathology Following Trauma. *Current Psychiatry Reports*, 17(8), 612-619. doi:10.1007/s11920-015-0612-y.
- Schnurr, P. P. (2014). A guide to the literature on partial PTSD. *PTSD Research Quarterly*, 25(1), 1-8.
- Schubert, S., & Lee, C. W. (2009). Adult PTSD and Its Treatment With EMDR: A Review of Controversies, Evidence, and Theoretical Knowledge. *Journal of EMDR Practice and Research*, 3(3), 117-132. doi:10.1891/1933-3196.3.3.117

- Schwerdtfeger, A. R., & Schlagert, H. (2011). The conjoined effect of naturalistic perceived available support and enacted support on cardiovascular reactivity during a laboratory stressor. *Annals of Behavioral Medicine*, 42(1), 64-78. doi:10.1007/s12160-011-9272-2
- Shah, A. J., Lampert, R., Goldberg, J., Veledar, E., Bremner, J. D., & Vaccarino, V. (2013). Posttraumatic stress disorder and impaired autonomic modulation in male twins. *Biological Psychiatry*, 73(11), 1103-1110. doi:10.1016/j.biopsych.2013.01.019
- Shaikh al arab, A., Guédon-Moreau, L., Ducrocq, F., Molenda, S., Duhem, S., Salleron, J., ... Vaiva, G. (2012). Temporal analysis of heart rate variability as a predictor of post traumatic stress disorder in road traffic accidents survivors. *Journal of Psychiatric Research*, 46(6), 790-796. doi:10.1016/j.jpsychires.2012.02.006
- Shannon-Baker, P. (2016). Making Paradigms Meaningful in Mixed Methods Research. *Journal of Mixed Methods Research*, 10(4), 319-334. doi:10.1177/1558689815575861
- Shapiro, F. (1995). *Eye movement desensitization and reprocessing: basic principles, protocols, and procedures*. New York, NY: Guilford Press.
- Shapiro, F. (2014). The Role of Eye Movement Desensitization and Reprocessing (EMDR) Therapy in Medicine : Addressing the Psychological and Physical Symptoms Stemming from Adverse Life Experiences. *The Permanente Journal*, 18(1), 71-77. doi:10.7812/TPP/13-098

- Shepherd, B. (2004). Risk Factors and PTSD: A Historian's Perspective. In G. M. Rosen (Eds.), *Posttraumatic Stress Disorder: Issues and Controversies* (pp.39-62). West Sussex: John Wiley & Sons.
- Sloan, R. P., Shapiro, P. A., Bigger, J. T., Bagiella, M., Steinman, R. C., & Gorman, J. M. (1994). Cardiac autonomic control and hostility in healthy subjects. *American Journal of Cardiology*, 74(3), 298-300. doi:10.1016/0002-9149(94)90382-4
- Smid, G. E., Mooren, T. T., van der Mast, R. C., Gersons, B. P., & Kleber, R. J. (2009). Delayed posttraumatic stress disorder: Systematic review, meta analysis, and Meta-Regression analysis of prospective studies. *The Journal of Clinical Psychiatry*, 70(11), 1478-1582. doi:10.4088/JCP.08r04484
- Smith, G. T., McCarthy, M., & Anderson, K. G. (2000). On the Sins of Short-Form Development. *Psychological Assessment*, 12(1), 102-111. doi:10.1037//1040-3590.12.1.102
- Smith, J. D. (2012). Single-case experimental designs: A systematic review of published research and current standards. *Psychological Methods*, 17(4), 510-550. doi:10.1037/a0029312
- Smith, K. (2011). Neuroscience vs philosophy: Taking aim at free will. *Nature*, 477(7362), 23-25. doi:10.1038/477023a.
- Solomon, R. M., & Shapiro, F. (2008). EMDR and the Adaptive Information Processing Model: Potential Mechanisms of Change. *Journal of EMDR Practice and Research*, 2(4), 315-325. doi:10.1891/1933-3196.2.4.315

- Stein, M. B., Walker, J. R., Hazen, A. L., & Forde, D. R. (1997). Full and partial posttraumatic stress disorder: Findings from a community survey. *American Journal of Psychiatry*, 154(8), 1114-1119. doi:10.1176/ajp.154.8.1114
- Stein, P. K., Bosner, M. S., Kleiger, R. E., & Conger, B. M. (1994). Heart rate variability: A measure of cardiac autonomic tone. *American Heart Journal*, 127(5), 1376-1381. doi:10.1016/0002-8703(94)90059-0
- Steinberger, A., Payne, J. D., & Kensinger, E. A. (2011). The Effect of Cognitive Reappraisal on the Emotional Memory Trade-off. *Cognitive and Emotion*, 25(7), 1237-1247. doi:10.1080/02699931.2010.538373.
- Stickgold, R. (2002). EMDR: A putative neurobiological mechanism of action. *Journal of Clinical Psychology*, 58, 61-75. doi:10.1002/jclp.1129
- Tambling, R. (2012). A Literature Review of Therapeutic Expectancy Effects. *Contemporary Family Therapy*, 34(3), 402-415. doi:10.1007/s10591-012-9201-y
- Tarrier, N., Liversidge, T., & Gregg, L. (2006). The acceptability and preference for the psychological treatment of PTSD. *Behaviour Research and Therapy*, 44(11), 1643-1656. doi:10.1016/j.brat.2005.11.012
- Tashakkori, A., & Teddlie, C. (2003). *Handbook of Mixed Methods in Social & Behavioral Research*. Thousand Oaks, CA: Sage.

Task Force of the European Society of Cardiology and the North American Society of Pacing and Electrophysiology (1996). Heart rate variability: standards of measurement, physiological interpretation and clinical use. *Circulation*, 93(5), 1043-1065. doi:10.1161/01.cir.93.5.1043

Thayer, J. F., Friedman, B. H., Borkovec, T. D., Johnsen, B. H., & Molina, S. (2000). Phasic heart period reactions to cued threat and nonthreat stimuli in generalized anxiety disorder. *Psychophysiology*, 37(3), 361-368. doi:10.1111/1469-8986.3730361

Thompson, R. F., & Spencer, W. A. (1996). Habituation: A model phenomenon for the study of neuronal substrates of behaviour. *Psychological Bulletin*, 73(1), 16-43. doi:10.1037/h0022681

Thoresen, S., Tambs, K., Hussain, A., Heir, T., Johansen, V. A., & Bisson, J. I. (2010). Brief measure of posttraumatic stress reactions: Impact of Event Scale-6. *Social Psychiatry and Psychiatric Epidemiology*, 45(3), 405-412. doi:10.1007/s00127-009-0073-x

Timulák, L., & Lietaer, G. (2001). Moments of empowerment: A qualitative analysis of positively experienced episodes in brief person-centred counselling. *Counselling & Psychotherapy Research*, 1(1), 62-73. doi:10.1080/14733140112331385268

Tolin, D. F., & Foa, E. B. (2006). Sex differences in trauma and posttraumatic stress disorder: A quantitative review of 25 years of research. *Psychological Bulletin*, 132(6), 959-992. doi:10.1016/S0005-7967(99)00030-3.

- Tryon, W. W. (2005). Possible mechanisms for why desensitisation and exposure therapy work. *Clinical Psychology Review*, 25(1), 67-95.
doi:10.1016/j.cpr.2004.08.005
- Tsai, J., Harpaz-Rotem, I., Pietrzak, R. H., & Southwick, S. M. (2012). The role of coping, resilience, and social support in mediating the relation between PTSD and social functioning in veterans returning from Iraq and Afghanistan. *Psychiatry*, 75(2), 135-149. doi:10.1521/psyc.2012.75.2.135
- Tsao, J. C. I., & Craske, M. G. (2000). Timing of treatment and return of fear: Effects of massed, uniform-, and expanding-spaced exposure schedules. *Behavior Therapy*, 31, 479-497. doi:10.1016/S0005-7894(00)80026-X
- Ursano, R. J., Bell, C., Eth, S., Friedman, M., Norwood, A., Pfefferbaum, B.,... Yager, J. (2004). Practice guideline for the treatment of patients with acute stress disorder and posttraumatic stress disorder. *The American Journal of Psychiatry*, 161(11), 3-31. doi:10.1176/appi.books.9780890423363.52257
- van den Hout, M. A., & Engelhard, I. M. (2012). How does EMDR work? *Journal of Experimental Psychopathology*, 3(5), 724-738. doi:10.5127/jep.028212
- van den Hout, M. A., Engelhard, I. M., Rijkeboer, M. M., Koekebakker, J., Hornsveld, H., Leer, A., ... Akse, N. (2011a). EMDR: Eye movement superior to beeps in taxing working memory and reducing vividness of recollections. *Behaviour Research and Therapy*, 49(2), 92-98. doi:10.1016/j.brat.2010.11.003

- van den Hout, M. A., Engelhard, I. M., Beetsma, D., Slofstra, C., Hornsveld, H., Houtveen, J., ...Leer, A. (2011b). EMDR and mindfulness. Eye movements and attentional breathing tax working memory and reduce vividness and emotionality of aversive ideation. *Journal of Behaviour Therapy and Experimental Psychiatry*, 42(3), 423-432. doi:10.1016/j.jbtep.2011.03.004
- van den Hout, M. A., Engelhard, I. M., Smeets, M. A. M., Hornsveld, H., Hoogeveen, E., De Heer, E., ...Rijkeboer, M. (2010). Counting During Recall: Taxing of Working Memory and Reduced Vividness and Emotionality of Negative Memories. *Applied Cognitive Psychology*, 24(3), 303-311. doi:10.1002/acp.1677
- van den Hout, M. A., Muris, P., Salemink, E., & Kindt, M. (2001). Autobiographical memories become less vivid and emotional after eye movements. *The British Journal of Clinical Psychology*, 40(2), 121-130. doi:10.1348/014466501163571
- Van Hooff, M., McFarlane, A. C., Baur, J., Abraham, M., & Barnes, D. J. (2009). The stressor Criterion-A1 and PTSD: a matter of opinion? *Journal of Anxiety Disorders*, 23(1), 77-86. doi:10.1016/j.janxdis.2008.04.001
- van Minnen, A., & Hageraars, M. (2002). Fear activation and habituation patterns as early process predictors of response to prolonged exposure treatment in PTSD. *Journal of Traumatic Stress*, 15(5), 359-367. doi:10.1023/A:1020177023209
- van Minnen, A., Hendriks, L., & Olf, M. (2010). When do trauma experts choose exposure therapy for PTSD patients? A controlled study of therapist and patient factors. *Behaviour Research and Therapy*, 48(4), 312-320. doi:10.1016/j.brat.2009.12.003

- van Minnen, A., Wessel, I., Dijkstra, T., & Roelofs, K. (2002). Changes in PTSD patients narratives during prolonged exposure therapy: a replication and extension. *Journal of Traumatic Stress, 15*(3), 255-258.
doi:10.1023/A:1015263513654
- van Veen, S. C., Engelhard, I. M., & van den Hout, M. A. (2016). The effects of eye movements on emotional memories: using an objective measure of cognitive load. *European Journal of Psychotraumatology, 7*, 30122-30133.
doi:10.3402/ejpt.v7.30122
- van Veen, S. C., van Schie, K., Wjingaards-de Meij, L. D. N. V., Little, M., Engelhard, I. M., & van den Hout, M. A. (2015). Speed Matters: Relationship between Speed of Eye Movements and Modification of Aversive Autobiographical Memories. *Frontiers in Psychology, 6*(45), 1-9. doi:10.3389/fpsy.2015.00045
- Vannest, K., Davis, J., & Parker, R. (2013). *Single case research in schools: Practical guidelines for school-based professionals*. New York, NY: Routledge
- Vetrugno, R., Liguori, R., Cortelli, P., & Montagna, P. (2003). Sympathetic skin response: Basic mechanisms and clinical applications. *Clinical Autonomic Research, 13*(4), 256-270. doi:10.1007/s10286-003-0107-5
- Vytal, K., Cornwell, B., Arkin, N., & Grillon, C. (2012). Describing the interplay between anxiety and cognition: From impaired performance under low cognitive load to reduced anxiety under high load. *Psychophysiology, 49*(6), 842-852.
doi:10.1111/j.1469-8986.2012.01358.x

- Wang, Y., Hensley, M. K., Tasman, A., Sears, L., Casanova, M. F., & Sokhadze, E. M. (2016). Heart Rate Variability and Skin Conductance During Repetitive TMS Course in Children with Autism. *Applied Psychophysiological Biofeedback*, 41(1), 47-60. doi:10.1007/s10484-015-9311-z
- Ware, J. E., Kosinski, M., & Keller, S. D. (1995). *SF-12: How to Scores the SF-12 Physical and Mental Health Summary Scales*. Boston, MA: The Health Institute, New England Medical Centre.
- Ware, J. E., Kosinski, M., & Keller, S. D. (1996). A 12-Item Short-Form Health Survey: construction of scales and preliminary tests of reliability and validity. *Medical Care*, 34(3), 220-233. doi:10.1097/00005650-199603000-00003
- Watts, T. (2014). *BrainWorking Recursive Therapy, The Professional Training Manual Level 1*. Essex, United Kingdom: Unpublished. Permissions are available from the original author.
- Watts, T., & Lockhat, R. (2017). *The Institute of BrainWorking Recursive Therapy, Training Materials*. Essex, United Kingdom: Unpublished. Permissions are available from the original author.
- Weathers, F. W., & Keane, T. M. (2007). The criterion a problem revisited: Controversies and challenges in defining and measuring psychological trauma. *Journal of Traumatic Stress*, 20(2), 107-121. doi:10.1002/jts.20210
- Wesson, M., & Gould, M. (2009). Intervening Early With EMDR on Military Operations: A Case Study. *Journal of EMDR Practice and Research*, 3(2), 91-97. doi:10.1891/1933-3196.3.2.91

- Westbrook, D., Kennerley, H., & Kirk, J. (2011). *An Introduction to Cognitive Behaviour Therapy: Skills and Applications*. London: Sage.
- Wilson, D., Silver, S., Covi, W., & Foster, S. (1996). Eye movement desensitisation and reprocessing: Effectiveness and autonomic correlates. *Journal of Behavior Therapy and Experimental Psychiatry*, 27(3), 219-229. doi:10.1016/s0005-7916(96)00026-2
- Wise, E. A. (2004). Methods for analyzing psychotherapy outcomes: A review of clinical significance, reliable change, and recommendations for future directions. *Journal of Personality Assessment*, 82(1), 50-59.
doi:10.1207/s15327752jpa8201_10
- Wolery, M., Busick, M., Reichow, B., & Barton, E. E. (2010). Comparison of overlap methods for quantitatively synthesizing single-subject data. *The Journal of Special Education*, 44(1), 18-28. doi:10.1177/0022466908328009
- Yarvis, J. S., & Schiess, L. (2008). Subthreshold posttraumatic stress disorder (PTSD) as a predictor of depression, alcohol use, and health problems in veterans. *Journal of Workplace Behavioral Health*, 23(4), 395-424.
doi:10.1080/15555240802547801
- Zlotnick, C., Franklin, C. L., & Zimmerman, M. (2002). Does “subthreshold” posttraumatic stress disorder have any clinical relevance? *Comprehensive Psychiatry*, 43(6), 413-419. doi:10.1053/comp.2002.35900

Appendix A: Protocol descriptions

Standard EMDR Protocol (Shapiro, 2001)

The standard EMDR protocol for treating addictions entails reprocessing traumatic incidents that are thought to underlie the addiction, including the current triggers that activate disturbance, and the development of future templates to install more adaptive behaviour. The latter is a form of relapse prevention for this patient group. The protocol comprises of eight steps, as follows; history taking and case formulation, patient preparation, assessment, desensitisation, installation, body scan, closure, and re-evaluation. Process measures are utilised throughout to ensure all aspects of the disturbing memory are completely resolved. These include the Subject Units of Distress (SUD), rating scale is 0 = no disturbance to 10 = the most disturbance possible, and the Validity of Cognition (VoC), rating scale is 1 = completely false to 7 = completely true, which is utilised to rate the patient's believability in their new positive cognition concomitant with the recalled memory after desensitisation. Particular attention is also played to patient's visceral response when recalling memories; memories are considered processed when patients report low SUDs, a high VoC and no body tension.

Feeling-State Addiction Protocol (FSAP) (Miller, 2010; 2012)

The FSAP target for reprocessing is the feeling-state (FS). The FS is conceived as a memory that has been isolated from the wider memory networks as a result of high psycho-physiological arousal of the body and is considered comparable to the maladaptive memories described in the AIP model. The key difference is the FS memory is caused by the high intensity of positive affect such as, euphoria and power which has become fixated with a specific object, behaviour, or substance. The FS becomes problematic when it leads to compulsive behaviours eventually forming an addiction. The FSAP is thought to work in a similar way to the standard protocol by expediting the information processing system, allowing for the FS to be assimilated within the larger adaptive memory networks, leading to a lessening or elimination of the addiction.

The protocol broadly follows 11 steps; however, the key modification involves the approach used in the processing of negative beliefs and the installation of positive belief. This first involves the desensitisation of the FS which is determined by the Positive Feeling Scale (PFS) instead of SUD, rating scale is 0 = no feeling to 10 = most intense positive feeling. A rating of 0 or 1 would indicate successful processing. Moreover, unlike the standard protocol the primary negative belief is thought to already be present before the FS formed. The negative beliefs are processed, and the positive beliefs installed using the standard protocol procedure and corresponding process measures; this phase is then repeated with any negative beliefs that have been created as a result of the addiction. The installation of the future template is focussed on how the patient will cope without having the positive feeling.

Desensitisation of Triggers and Urge Reprocessing Protocol (DeTUR) (Popky, 2005)

The DeTUR targets triggers and urges identified by the patient that evoke the addictive behaviour. However, prior to this the protocol first seeks to reinforce positive coping by focusing on the patient's positive treatment goal, which is a conjured image of what life may look like when changes are made to the addiction, be it abstinence or harm reduction. Following this, a hierarchy of triggers is first constructed with the patient, from the lowest urge to the highest. This protocol uses only Level of Urge (LOU) as measurement, the rating is 0 = lowest urge and 10 = strongest urge, and each trigger is desensitised until the urge becomes 1 or 0. Once desensitised, triggers are no longer the stimuli for using. Unlike the other protocols the DeTUR focusses only on LOU and body sensation and does not attend to cognition or emotion. Dissimilar to exposure the protocol does not require repeated focusing on a trigger/ cue but rather moves with the patient's spontaneous free associations. The protocols attention is primarily the present and future, however, will address past memories should they arise.

CravEx (Hase et al., 2008; 2010)

The CravEx targets the addiction memory (AM) which consists of both a memory of relapse or loss of control, and a memory of intense craving associated with the respective addiction. Internal and external cues are thought to activate the AM leading to addictive behaviour. The authors purport that the cue-reactivity of AM resembles that of the traumatic memory formation inherent in PTSD and, therefore, the AM is considered to play an important role in relapse and the maintenance of learned addictive behaviour. Subsequently, reprocessing of the AM should lead to measurable changes in addiction symptomatology including a reduction in involuntary craving. To achieve this the protocol follows a similar structure to that of the standard protocol, the fundamental differences are the target of processing and measurement strategy (LOU only).

Appendix B: Database search strategies

PsycINFO (date of search: 23/06/16)

Search strategy: PsycINFO

Search results: 150

DE "Addiction" OR DE "Alcoholism" OR DE "Drug Addiction" OR DE "Internet Addiction" OR DE "Process Addiction" OR DE "Sexual Addiction" DE "Drug Abuse" OR DE "Drug Usage" OR DE "Alcohol Abuse" OR DE "Drug Dependency" OR DE "Addiction" OR DE "Craving" OR DE "Drug Abstinence" OR DE "Drug Addiction" OR DE "Substance Abuse and Addiction Measures" OR DE "Substance Use Disorder" DE "Gambling" OR DE "Pathological Gambling" OR addic* OR gambl* OR alcohol* OR drug* OR substance* OR craving AND DE "Eye Movement Desensitization Therapy" OR EMDR OR eye movement desensiti?ation OR eye movement desensiti?ation reprocessing OR eye movement therapy

EMBASE (date of search: 23/06/16)

Search strategy: EMBASE

Search results: 110

EMDR.mp. OR eye movement desensiti?ation.mp. OR eye movement therapy.mp. OR eye movement desensiti?ation reprocessing.mp. AND drug dependence/ OR alcohol/ or alcohol abuse/ OR "alcohol use disorder"/ OR "substance use"/ OR substance abuse/ OR pathological gambling/ or gambling/ OR sexual addiction/ OR exp addiction/ OR (addic* OR gambl* OR drug* OR substance* OR alcohol* OR craving).mp.

Medline (date of search: 23/06/16)

Search strategy: Medline

Search results: 65

(MH "Substance-Related Disorders") OR (MH "Alcohol-Related Disorders") OR (MH "Gambling") OR (MH "Alcoholism") OR addic* OR gambl* OR drug* OR alcohol* OR substance* OR craving AND (MH "Eye Movement Desensitization Reprocessing") OR EMDR OR eye movement desensiti?ation OR eye movement desensiti?ation reprocessing OR eye movement therapy

Pilots (date of search: 23/06/16)

Search strategy: Pilots

Search results: 81

(EMDR OR SU.EXACT ("EMDR") OR (eye movement desensiti?ation) OR (eye movement therapy) OR (eye movement desensiti?ation reprocessing)) AND SU.EXACT ("Drug Abuse") OR SU.EXACT ("Sexual Risk Taking") OR SU.EXACT ("Alcohol Abuse") OR SU.EXACT ("Impulse-Control Disorders") OR (addict* OR gamble* OR drug* OR alcohol* OR substance* OR craving))

Francine Shapiro Library (date of search: 23/06/16)

Search strategy: Francine Shapiro Library

Search results: 33

Addict (in Keywords or Title; pre-select journals only)

Appendix C: Platinum standard item description (Adapted from Hertlein & Ricci, 2004)

Item #1 Clearly defined target symptoms

- 0: no clear diagnosis or symptom definition
- 0.5: not all participants meet target symptom criteria
- 1.0: all participants meet target symptom criteria

Item #2 Reliable and valid measures

- 0: did not use reliable and valid measures
- 0.5: measures used inadequate to measure change
- 1.0: reliable, valid, and adequate measures used

Item #3 Use of blind, independent assessor

- 0: assessor was therapist
- 0.5: assessor was not blind
- 1.0: assessor was blind and independent

Item #4 Assessor reliability

- 0: no training in administration of instruments used in the study
- 0.5: training in administration of instruments used in the study
- 1.0: training with performance supervision, or reliability checks

Item #5 Manualized, replicable, specific treatment

0: treatment was not replicable or specific

0.5: treatment replicable & specific but not standard EMDR protocol

1.0: treatment followed EMDR training manual (Shapiro, 1995)

Item #6 Unbiased assignment to treatment

0: assignment not randomized

0.5: only one therapist or other semi-randomized designs

1.0: unbiased assignment to treatment

Item #7 Treatment adherence

0: treatment fidelity poor

0.5: treatment fidelity variable or self-monitored by therapist only

1.0: treatment fidelity independently checked and adequate

Item #8 Non-confounded conditions (e.g., concurrent psycho-therapy or psychopharmacology, violent household, etc.)

0: most participants exposed to confounds with no control for variables

0.5: few participants exposed to confounds with no control for variables

1.0: confounds non-existent or controlled for (e.g., exclusion, matched assignment, etc.)

Item #9 Use of multimodal measures

0: self-report measures only

0.5: self-report plus interview of physiological or behavioural measures

1.0: self-report plus two or more other types of measures

Item #10 Length of treatment

0: 1-6 sessions

0.5: 7-10 sessions

1.0: 11+ sessions

Item #11 Reported level of therapist(s) training

0: no qualifications for treating clinicians provided

0.5: qualifications for treatment group, clinicians provided

1.0: qualifications for treatment and comparative group, clinicians provided

Item #12 Use of control or comparison group

0: no use of a wait control/comparison group

0.5: use of a comparison group but no control

1.0: use of a no-treatment control group

Item #13 Effect size reporting

0: no effect size reported

1.0: effect size reported

Appendix D: Ethics Approval



Miss Hayley Rose
Department of Clinical Psychology,
Bridge House,
University of Lincoln,
Brayford Pool Lincoln,
Lincolnshire LN6 7TS

Email: hra.approval@nhs.net

Letter of HRA Approval

20 March 2017

Dear Miss Rose

Study title:	Brain Work Recursive Therapy (BWRT) for non-complex trauma: A case series approach.
IRAS project ID:	219946
Protocol number:	N/A
REC reference:	17/EE/0056
Sponsor:	University of Lincoln

I am pleased to confirm that **HRA Approval** has been given for the above referenced study, on the basis described in the application form, protocol, supporting documentation and any clarifications noted in this letter.

Appendix E: Participant information sheet



Participant Information Sheet (Version 2.0, 3rd March, 2017)

Title of Study: Brain Work Recursive Therapy (BWRT) for non-complex trauma: A case series approach.

Researcher: Hayley Rose

Supervisors: Dr Thomas Schroder and Dr Dave Dawson

You are being invited to take part in a research study. You do not have to decide today whether or not you will participate in the research. I am going to give you information on why the research is being done and what it would involve for you. Please read this information sheet and contact us with any questions you have, either via email (see contact details below) or at our face to face meeting should you choose to know more.

What is the purpose of the study?

Brain Work Recursive Therapy (BWRT) is a therapeutic approach that was developed in 2011. It is currently being used by therapists working with diverse conditions such as Chronic Fatigue Syndrome, Generalised Anxiety Disorder, and Post-traumatic Stress Disorder. As discussed with your group facilitator, BWRT works on changing your brains neural patterns that have become problematic for you. Whenever we learn something new a new neural pathway is created which becomes stronger the more it is used. Sometimes with good effect and sometimes with bad effect. In its simplest form BWRT closes down the neural pathway, which is causing the problem, with the negative emotion attached and opens a new neural pathway with positive emotion attached, this is achieved by a series of special visualisation and imagination techniques. The effectiveness and efficiency reported by therapists and clients has been very positive. However, research is needed to further investigate these effects and better our understanding of how BWRT can be a helpful therapy.

Why have I been invited?

You are being invited to take part because you have completed the 10 week psycho-educational group for Chronic Fatigue Syndrome, and have since identified potential trauma related difficulties you wish to work on. BWRT is a routinely offered therapy within the service, however, we would like to offer you the opportunity to receive this therapy whilst being part of a research study.

Do I have to take part?

Participation is entirely voluntary. It is your decision whether or not to take part. If you do decide to take part you will be asked to read a consent form and sign this if you agree. If you decide to take part you are still free to withdraw either before or during the study without giving a reason.

What will happen to me if I take part?

Firstly you will meet with the lead researcher (Hayley Rose) to further discuss the study details. This will include completing a screening measure which is only given once at the start of the study. The measure is used to determine the type of traumatic event you have experienced which you wish to focus on during your BWRT, however, you will not be required to share any further details regarding this. The measure provides examples of different types of trauma events someone may encounter such as illness, a car accident, sexual assault, bereavement etc. Following this meeting you will be placed on the service waiting list as normal, and your therapy will start in approximately 3-5 weeks' time. You will be asked to complete two short questionnaires while on the waiting list and throughout the study, these questionnaires will ask you about your physical and mental health. The questionnaires will be made accessible from your mobile phone and/or computer, and you will receive a twice weekly SMS message reminder prompting you to complete these. In addition, upon completing BWRT you will be asked to complete a further questionnaire which will also be repeated at the follow ups described below. In addition, you will be given two 1-item measures at the beginning and end of your BWRT session to complete, and this will be a paper-based form.

The study is also interested in measuring your Heart Rate Variability (HRV) during your therapy session(s). This will be measured using a combined chest-strap and watch heart rate monitor. The chest-strap is placed next to the skin under clothing, and is fastened across the chest. In order to gain a base heart rate before your therapy session starts, you will be asked to arrive 15 minutes before your appointment to allow time to attach the chest-strap yourself and to monitor your HRV for a minimum of **5 minutes** before starting your session. When you have finished your session you can then hand in your watch and chest-strap to your therapist. Also, a 10 minute recording of your HRV will be taken at the pre-intervention meeting, along with a demonstration on how to use the device. A final 10 minute recording will be taken at the one month follow up interview (described below).

You will receive the same number of allocated therapy sessions you would receive if you were not part of the study. Your sessions will be audio recorded, this will allow the researcher to view the content of your sessions which is then used to help interpret the study findings. When you have completed therapy you will be invited to attend an interview with the researcher (Hayley Rose). The interview will take place approximately one month after you have completed your BWRT. This interview will involve the interviewer playing excerpts from the audio recordings of your session(s) to discuss specific points of therapy, and gain an understanding of your experiences at these times. The second part of the interview provides an opportunity to share your broader experiences of BWRT for trauma, and discuss any issues of particular importance to you. The

interviews will be conducted at the same clinic as your therapy. It is intended that the interview will last for no longer than one hour. Interviews will be audio recorded, transcribed into print and then analysed by the research team.

What are the possible disadvantages and risks of taking part?

We believe there are no known risks associated with this research study, however, as with any therapy there is no guarantee that BWRT will work for you. Your therapist will always provide the treatment that they judge to be most beneficial to you, therefore if BWRT is not helpful you will be offered alternative treatment in line with service guidelines, or if required a referral will be made on your behalf to another service.

What are the possible benefits of taking part?

As noted earlier, we cannot guarantee that BWRT will be helpful for you, however we hope this will be the case based on current practice that suggests BWRT may be a new promising treatment for many difficulties. Your participation will aid our understanding of BWRT and its use for trauma, and the findings will be of benefit to guide future research and therapy for others. To thank you for your time and contribution you will receive a £10 Amazon voucher. This will still be given even if you who choose to withdraw from the study.

What if there is a problem?

If you have a concern about any aspect of this study, you should ask to speak to the researcher who will do their best to answer your questions. The researcher's contact details are provided at the end of this information sheet. If you remain unhappy and wish to complain formally, you can do this by contacting the School of Psychology Research Ethics Committee (SOPREC) at College of Social Science, University of Lincoln, Brayford Pool, Lincoln, Lincolnshire, LN6 7TS, or email at soprec@lincoln.ac.uk.

Will my taking part in the study be kept confidential?

Ethical and legal practice will be followed and all information will be handled in confidence. You will be assigned a code number under which your data, namely demographic information (*age, gender, marital status, employment status, history of engagement with mental health services, past and/or current diagnoses, past and present medication use*), questionnaire scores, HRV recordings, audio recordings and transcripts will be stored. This information will be kept strictly confidential on a password protected computer-file and on the online system (Qualtrics) used to access your questionnaires. Both will only be accessible by the researcher. If you choose to take part, some parts of the data including therapy audio recordings may be viewed by the research team named above, however, the research team will not have access to any personal identifiable data. Interview audio recordings will be deleted following transcription. Your consent form and coded password-protected electronic data will be stored for seven years as per University policy at the University of Lincoln. After this time your data will be disposed of securely. Additionally, medical notes and data collected in the study may be looked at by NHS regulatory authorities where it is relevant to your taking part in this study, for the purpose of ensuring all ethical

standards of this study are being upheld.

What will happen if I don't want to carry on with the study?

Your participation is voluntary and you are able to withdraw at any time, without explanation, and you will still continue to receive the same care provided by the service. You can do this by contacting the researcher on the email address listed below. If you continue with the study but wish to have your data removed, you can do this up until two weeks following your last data collection. After this time, your data cannot be erased as it may already be included in the analysis and reports.

What will happen to the results of the study?

Once the study is completed, results will be shared with other professionals by submitting the report for publication in professional and academic journals. All information will be anonymised. We can also send you a brief summary of the research findings via post or email once the study has finished if you wish. You can request this information by contacting the lead researcher (Hayley Rose) on the email listed below. A brief summary of the findings will also be shared with the Physical Health Psychology service.

Who is organising and funding the research?

This research is being organised by the University of Lincoln and is being funded by the Trent Doctorate in Clinical Psychology.

Who has reviewed the study?

This study has been reviewed and given approval by the University of Lincoln and the Cambridgeshire and Hertfordshire Research Ethics Committee.

Future Research

Following your participation in this research study there may be opportunity for you to be involved in a further research project by the University of Lincoln, looking into the longer-term effects of BWRT at a later date. Participation is entirely voluntary. Should you choose to take part in this study, then the consent form you will be given will ask whether or not you consent to be contacted for future research. If you do decide not to consent to be contacted this will not affect your participation in this study. If you do provide consent and are contacted by the University of Lincoln you are still free to withdraw, without giving a reason.

Further information and contact details

Hayley Rose (15591140@students.lincoln.ac.uk), DClinPsy, School of Psychology, University of Lincoln, Brayford Pool, Lincoln LN6 7TS.

Appendix F: Impact of Events Scale-6 measure

Version 1.0, 13th of January, 2017

IMPACT OF EVENTS SCALE-6 (IES-6)

INSTRUCTIONS: Below is a list of difficulties people sometimes have after stressful life events. Please read each item, and then indicate how distressing each difficulty has been for you

DURING THE PAST SEVEN DAYS with respect to _____

_____ (event) that occurred on _____ (date). How much have you been distressed or bothered by these difficulties?

	Not at all	A little bit	Moderately	Quite a bit	Extremely
1. I thought about it when I didn't mean to	0	1	2	3	4
2. I felt watchful or on-guard	0	1	2	3	4
3. Other things kept making me think about it	0	1	2	3	4
4. I was aware that I still had a lot of feelings about it, but I didn't deal with them	0	1	2	3	4
5. I tried not to think about it	0	1	2	3	4
6. I had trouble concentrating	0	1	2	3	4

Total IES-6 Score: -----

Appendix G: GP letter

Version 1.0, 13th January, 2017

PSYCHOLOGY SERVICE ADDRESS

DATE

Dear Dr X,

Re: Mr/ Mrs/ Miss X; NHS No.; D.O.B.;

We are writing to inform you that the above named client has recently consented to take part in a research study investigating the efficacy of Brain Work Recursive Therapy (BWRT). BWRT is a new model of psychotherapy conceived in 2011 that is determinedly solution-focused, promoting rapid resolution of psychological distress. BWRT is routinely offered within the Physical Health Psychology service to those clients identifying a further mental health need after completing the 10 week Chronic Fatigue Syndrome psycho-educational group. The effectiveness and efficiency of BWRT as reported by therapists and clients is so far extremely positive, however, there remains little controlled research examining its use.

This study is being conducted by the University of Lincoln, and involves a mixed method approach. Recruited participants will be asked to complete outcome measures on a weekly basis, wear a heartrate variability device (chest strap and wrists watch) during the therapy session(s), and attend a qualitative interview with the lead researcher, Hayley Rose, approximately one month following the last BWRT session to reflect on their experiences of therapy, and receive a verbal and written debrief on their participation in the study thus far. At two months following the last BWRT session, participants will be asked to complete a final battery of online measures. Participants can expect to be involved in the study for 12-16 weeks, however, all participants are informed of their right to decline participation in the study, and/or to withdraw consent to participate at any time without negative consequence.

As Mr/ Mrs/ Miss X has already consented to take part in the research, there is nothing further you need to do. However, if you have any queries or concerns about their involvement then please do not hesitate to get in touch with the service and/ or research team (details below). In the absence of any contra-indicators from yourself, we intend to commence therapy in 2-4 weeks from the date of this letter.

Kind regards

XXXX

Appendix H: Participant consent form



Participant Consent Form (Version 2.0, 3rd March, 2017)

Title of Study: Brain Work Recursive Therapy (BWRT) for non-complex trauma: A case series approach.

Ethics Committee ref: 219946

Name of Researcher: Hayley Rose

Name of Participant:

Please initial box:

1. I confirm that I have read and understand the information sheet version number 2.0 dated 3rd March, 2017 for the above study and have had the opportunity to consider the information and ask questions. ☐
2. I understand that my participation is voluntary and I am free to withdraw at any time, without giving any reason, and without any effect on the usual care I would receive from the service. I understand that I have two weeks following the end of my data collection to withdraw my data, and that after this time my data collected cannot be erased and may still be used in the project analysis. ☐
3. I understand and agree that multiple outcome measures will be taken during the research for the analysis of the impact of BWRT on my wellbeing. ☐
4. I give permission for the researcher to collect, store, analyse and publish information gained from my participation in this study. I understand that my personal details will be anonymised and kept confidential. ☐
5. I understand that my therapy sessions and my interview with the researcher will be audio recorded and transcribed. I understand that anonymous direct quotations from the interview may be used in the study reports. ☐
6. I agree to my GP being informed of my participation in this study. ☐
7. I understand that relevant sections of my medical notes and data collected in the study may be looked at by NHS regulatory authorities where it is relevant to my taking part in this study, for the purpose of ensuring all ethical standards of this study are being upheld. ☐

8. I understand that I may be contacted by the University of Lincoln to participate in a ☐ future BWRT research project, but I am able to opt out of this if I so wish, by ticking the box below:

☐

If you would like to be contacted regarding future ethically approved research please provide the email address you wish to be contacted on below:

.....

9. I agree to take part in the above study.

☐

Name of Participant

Date

Signature

of Person taking consent

Date

Signature

Name

3 copies: 1 for participant, 1 for the project notes and 1 for the medical notes

Appendix I: Hospital Anxiety and Depression Scale-4

The following four items were selected on the basis of factor loadings and face validity;

- Item 2: I still enjoy things I used too
- Item 4: I can laugh and see the funny side of things
- Item 5: Worrying thoughts go through my mind
- Item 9: I get a sort of frightened feeling like butterflies in the stomach

The response scale was adapted, asking participants how they have been feeling over the 'past three days'.

Appendix J: In-session memory ratings scale

Version 1.0, 13th of January, 2017

Participant number:

Date:

Pre / Post

Likert scales for impact on memory

When you are thinking about the unpleasant memory please rate how intense the impact of it is. Please mark on the line to show the memories impact in terms of emotional response (does it make you have strong feelings?), and vividness (how bright or detailed it is?) on a scale of 0-10 where 0= no impact and 10=extreme impact.

		0	1	2	3	4	5	6	7	8	9	10	
Emotionality	No emotion	<hr/>											Extremely emotional
Vividness	Not clear at all	<hr/>											Extremely vivid

Note. The measure is administered verbally and scored by the therapist.

Appendix K: Interview schedule



Semi-structured Interview Schedule (Version 1, 13th January 2017)

Adapted from (Elliott, 2012) Change Interview

Introduction for Participant

The main purpose of this interview is to allow you to tell us about your experience of BWRT therapy. The main topics we will cover include any changes you may have noticed since therapy started, what you believe may have caused these changes, and what you experienced as helpful and/or unhelpful in therapy. There is flexibility in the interview so that you can discuss issues of particular relevance to you.

Topic: Past Therapy

1. What was your experience of BWRT for trauma?
 - a. How does this compare to your past experiences of therapy? *(If relevant for participant)*

Topic: Change

2. What changes, if any, have you observed in yourself since completing BWRT?
 - a. How important do you consider this change to be?
 - b. Has there been any negative/positive changes for you?
3. Is there anything that you wanted to change that didn't since completing BWRT?

Topic: Attributions

4. In general, what do you believe has caused these various changes? *(Consider things inside and outside of therapy, and the impact of the 10 week group prior to BWRT)*

Topic: Helpful Aspects

5. Can you describe what has been helpful about your therapy? *(general and specific events)*

Topic: Unhelpful Aspects

6. What parts of therapy have been unhelpful for you? (*general/ specific events*)
7. Were there parts of therapy which were difficult but still OK or helpful? Please give examples.
8. Has anything been missing from your treatment? If yes, elicit examples of what would have made therapy more helpful.

Topic: Suggestions

9. Do you have any suggestions for us, regarding the research or the therapy?

Appendix L: Participant debrief letter



Brain Work Recursive Therapy (BWRT) for non-complex trauma: A case series approach

Research Debrief (following qualitative interview)

Version 2.0, 3rd of March, 2017

Thank you very much for taking the time to partake in this research. Your input is greatly valued, and your efforts will help us to more fully understand the possible benefits of BWRT, and the processes behind this therapy.

The results from your measures have been anonymised. The interview will also now be transcribed and anonymised. As discussed, you will be able to withdraw your contribution to the research up until two weeks following your last data collection. After this time, your data cannot be erased as it may already be included in the analysis and reports. As outlined at the start of the study, we will send you a final text reminder in one months time to complete the last battery of online questionnaires.

If you would like a summary of the research findings please contact the lead researcher (Hayley Rose) on the details listed below, and this information will be sent to you following the studies completion. Also, if you have given consent you may be contacted by the University of Lincoln regarding future research into the longer-term effects of BWRT at a later date.

Whilst we hope the BWRT was beneficial to you, we recognise that not all individuals will find it helpful. If you are still experiencing difficulties and would like further support you can contact the service to discuss further support options, and/or the possibility of an onward referral to a different psychological service which can be made on your behalf. Additionally, see below for contact details of other external support services you may wish to contact:

- NHS Crisis (Single Point of Access): 0303 123 4000
- Samaritans (24 hours): 08457 909090, www.samaritans.org
- You may also wish to visit your GP/ health care professional

Please be aware that if you wish to make a formal complaint about any aspects of the research, you can contact the School of Psychology Research Ethics Committee using the following details:

School of Psychology Research Ethics Committee (SOPREC)
College of Social Science
University of Lincoln
Brayford Pool

Lincoln
Lincolnshire
LN6 7TS
email: soprec@lincoln.ac.uk.

Once again, thank you for your continued input.

Kind Regards,

Hayley Rose

Contact details:

Chief Investigator

Hayley Rose: 15591140@students.lincoln.ac.uk

Supervised by:

Dr Thomas Schroder Thomas.Schroder@nottingham.ac.uk

Dr Dave Dawson ddawson@lincoln.ac.uk

Postal contact details:

Department of Clinical Psychology

Bridge House

University of Lincoln

Brayford Pool

Lincoln

Lincolnshire

LN6 7TS

Brain Work Recursive Therapy for Non-Complex Trauma: A Case Series Design

Hayley L. Rose | Dave L. Dawson | Thomas Schröder | Anne Abey

Trent Doctorate in Clinical Psychology

Introduction

- Adverse life events can produce effects comparable to major trauma causing significant psychosocial impairment and financial cost, both on personal and societal levels¹.
- Existing trauma therapies recommended by NICE² are limited to Trauma-focused Cognitive Behavioural Therapy (TF-CBT) and Eye Movement Desensitisation Reprocessing (EMDR).
- EMDR and TF-CBT are both evidence-based treatments with a substantiated body of research supporting their use, yet, their tolerability and longevity of effects remain questionable³.
- A recent addition to the trauma treatment arena is Brain Work Recursive Therapy (BWRT). BWRT postulates problematic neuronal pathways as the primary basis of clinical pathology; whereby, the brain initiates a 'best match' response when incoming data from the environment is recognised. Problems arise when the patterns of responding are unsuitable to current life. BWRT is considered to modify the pattern matching process and reprogramme a desired response⁴.
- BWRT appears to share procedural elements compatible with EMDR, namely dual taxation of working memory, whereby the client is encouraged to focus on the traumatic memory while also attending to auditory stimuli (therapist speed talking). This is considered to reduce the episodic quality of the target memory⁵ leading to concurrent reductions in memory vividness and emotionality⁶.
- Despite the absence of controlled research, BWRT is currently being used by private and NHS clinical psychologists working with diverse conditions such as CFS, Generalised Anxiety Disorder, and PTSD, with anecdotal reports appearing positive, even with brief interventions⁷.
- However, questions remain regarding if, and how, BWRT works, therefore, this current study is considered an important piece of work towards the efficacy and evidence development of this nascent therapy.



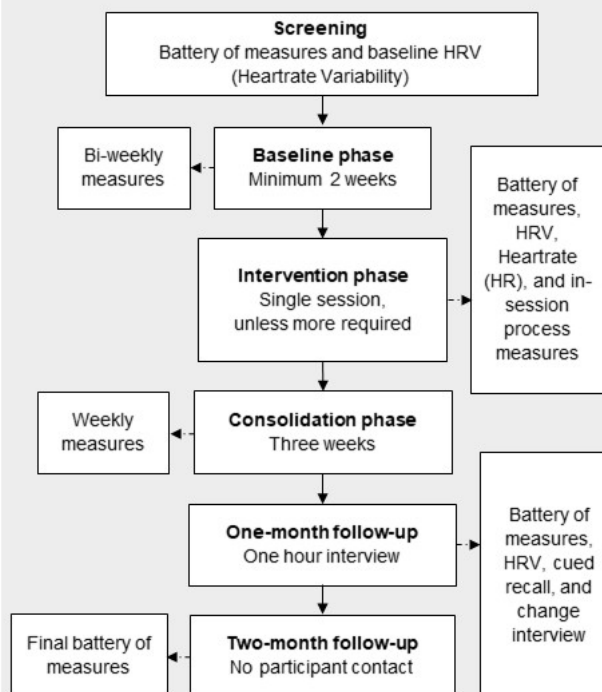
Aims

This study aimed to investigate the following three questions:

- Is Level 1 BWRT effective in treating non-complex trauma?
- Can the mechanism(s) of change in BWRT be elucidated through process measures?
- How do participants experience BWRT?

Method

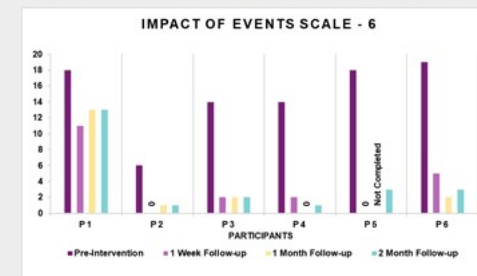
This exploratory study utilised a multiple single-case experimental design (n=6) and implemented a psychosomatic, mixed-method approach:



Results

Impact of Events Scale-6:

- Four participants showed reliable and clinically significant reduction from pre-intervention to 1 week follow-up, which were maintained or further improved at subsequent follow-ups.

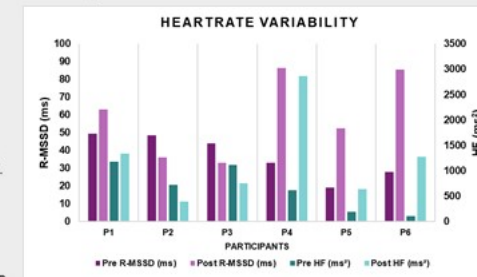


Hospital Anxiety and Depression Scale:

- Psychological distress appeared to positively co-vary with changes on the IES-6 across phases.

Short Form Health Survey -12:

- Concurrent improvements were demonstrate. Some regressions in scores were noted; yet, for the Mental Component Scale, participants did not return to baseline levels.



In-session Process Measure (Memory ratings):

- Average pre-scores for perceived arousal and vividness were 8 and 9 respectively and at the last recursive loop were 1 and 2.6 comparatively.

HRV and HR:

- All participants experienced a rise in parasympathetic activity and a decrease in HR at the end of treatment, indicative of arousal reduction. Four participants showed an increase in HRV variables from pre- to post-treatment.

Qualitative:

- Five participants found BWRT helpful and considered the intervention responsible for change. Limited exposure to the trauma memory and the immediacy of improvement experienced, was cited as positive aspects of the therapy.

Discussion

- This was an exploratory study offering the first controlled research of BWRT. The results demonstrated an overall improvement with both psychological tests and HRV measures offering support for the effectiveness of BWRT for non-complex trauma; a finding that was substantiated by participants qualitative reports.
- Findings suggest BWRT may have harnessed a key factor (dual taxation of working memory) that is considered to influence outcome in EMDR, yet, notably this is limited to by-proxy measurement of internal processes.
- Future research recommendations include the use of additional physiological measurement, working memory assessments to determine the effects of working memory capacity on outcome and the use of dismantling studies to decompose the multi-components of this nascent therapy.